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ABSTRACT

The purposes of this report are: to describe the main elements of the U.S. agricultural extension model and its effects on the agricultural revolution; to analyze attempts to extend this model to non-agricultural technology and/or to less developed countries; and to draw general conclusions about the diffusion of technological innovations, with implications for research and action. The following main elements in the agricultural extension model are identified: a critical mass of new technology; a research sub-system oriented to utilization; a high degree of user control over the research utilization process; structural linkages among the research utilization systems's components; a high degree of client contact by the linking sub-sytem; a "spannable" social distance across each interface between components in the system; evolution as a complete system; and a high degree of control by the system over its environment. The analysis of model application to seven different cases (Social and Rehabilitation Service, Office of Education, National Diffusion Network Program, family planning, developing nations, and diffusion of technology among private manufacturing firms) indicates: little success with SRS application due to the neglect of certain elements of the model; more OE and SRS success; little success when transferred to agricultural applications in developing nations; greatest success with adaptation to the family planning context; and little success in industry applications of the model. (JC)

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EXTENDING THE AGRICULTURAL EXTENSION MODEL

by

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September, 1976

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PREFACE

In one sense, work on the present report began years ago when one of the authors (Everett Rogers) was employed as a state Extension specialist, a researcher in an Agricultural Experiment Station, and an administrator in a state Agricultural Extension Service. Rogers' early research (in the 1950's and early 1960's) centered on the diffusion of agricultural innovations to farmers in Iowa and Ohio, and especially on the role of Extension Service personnel in this process. The present report reflects this close personal acquaintance with the agricultural extension model.

Two agencies in the U.S. Department of Health, Education and Welfare (DHEW) initiated pilot projects in the late 1960's and early 1970's in which they tried out an adaptation of the agricultural extension model. One agency is the Social and Rehabilitation Service (SRS), which in 1969 launched a pilot project in which nine research utilization specialists were employed to assist SRS officials in putting research-based innovations into practice. A sister DHEW agency, the U.S. Office of Education (OE), launched a parallel pilot program of educational extension agents in 1970. Dr. Rogers was a consultant to both the SRS and OE pilot projects as they attempted to adapt the agricultural extension model, and extend it into these new applications.

During the same period, J.D. Eveland was a program analyst with the U.S. Department of Health, Education and Welfare, and was extensively involved in the problems of relating federally-sponsored research activities to federal program operations. He worked for a year in the U.S. Office of Education, and was involved in a task force study conducted by the Office of the Secretary on several aspects of the SRS. His observations derived from his federal experience, and from the experiences of his colleagues in both OE and SRS, help form the basis of our interpretation of the two HEW case analyses.

Fortunately, both agencies' pilot efforts in extending the agricultural extension model were subjected to thorough evaluation, and the reports from these evaluation researches are drawn upon in the present report as a guide to formulating our conclusions.

Two other main efforts to extend the agricultural extension model that are analyzed in this report, occurred in the less developed countries of Latin America, Africa, and Asia. One was the attempt to create agricultural extension services in these countries to reach peasant farmers with technological innovations in agriculture. Another effort, aimed at a similar audience, is represented by national family planning programs. Both approaches have been analyzed in various research studies by Everett Rogers and his colleagues over the past decade in about a dozen countries.

In a latter section of this report we discuss the applicability of the agricultural extension model to the case of private manufacturing firms. Here, Dr. Alden Bean has the most relevant experience, stemming from his many years of industrial marketing work, his subsequent research at Northwestern University on industrial innovation, and his current position in the Division of Policy Research and Analysis of the National Science Foundation, where he manages a program of research on technological innovation processes. A variety of federal government-sponsored efforts have been initiated in past years to apply the agricultural extension model to diffuse technological innovations to private manufacturing firms in the United States. We review several of these programs, and seek to draw conclusions about the applicability of the agricultural extension model in the industrial context.

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EXTENDING THE AGRICULTURAL EXTENSION MODEL

by

Everett M. Rogers, J.D. Eveland, and Alden S. Bean*

INTRODUCTION

The purposes of this report are (1) to describe the main elements of the U.S. agricultural extension model, and its effects on the agricultural revolution, (2) to analyze attempts to extend this model to non-agricultural technology and/or to less developed countries, and (3) to draw general conclusions about the diffusion of technological innovations, with implications for research and action.

The U.S. agricultural extension model is undoubtedly the most widely-recognized system for the diffusion of innovations in the world. No other federal/state agency claims to be relatively more successful in transferring technology. The agricultural extension services of the U.S. are reputed to have been spectacularly successful in diffusing agricultural research results to farmers, and in thus raising their levels of agricultural productivity. Later in this report, we question whether this reputation for success is completely deserved.

The Committee on Intergovernmental Science Relations, established by the Federal Council for Science and Technology to explore the interaction of federal, state, and local government research and development policies and programs, concluded in its report, Public Technology: A Tool for Solving National Problems (1972), that:

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> It is instructive to look at one example of a federal technology transfer program in a specific field that has a proven record of achievement, state and local involvement, and political durability: The Agriculture Department's Extension Service, Cooperative State, and Land-Grant University System. In this system, the functions of identifying and disseminating and applying it [technology] in the field are well integrated. A key element in the success of the Extension Service, for instance, is an effective local-federal feedback mechanism. The agents live in a community, know its people, and are directly concerned with its problems. They are effective communicators on problems requiring technical know-how. They become aware of the concerns of the farmer, related business and community leaders, and thus can give meaningful direction to new research or modification of existing techniques. A two-way flow of information is thus an integral part of the Department's operations.

In any event, the agricultural extension model has had a very strong effect on the "classical diffusion model",* and vice versa. The most influential diffusion research study of all time is undoubtedly the Ryan and Gross (1943) investigation of hybrid seed corn among Iowa farmers. This research was sponsored by the Iowa Agricultural Experiment Station, a sister institution to the Iowa Agricultural Extension Service at Iowa State University, and the results of the hybrid corn study were directly put into use by the Iowa Agricultural Extension Service. So a mutually beneficial relationship between agricultural diffusion researchers and agricultural extension workers grew up during the 1940's and 1950's in the U.S. By 1960, the intellectual picture of the diffusion of innovations that had emerged (Rogers, 1962) was very heavily influenced by the fact that the majority of the 405 diffusion studies then completed were in U.S. agriculture. By 1976, when diffusion studies numbered about 3,500, the relative importance of agricultural innovation studies had decreased considerably, but the U.S. agricultural extension model still had left an indelible stamp on academic conceptions of the diffusion model.

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*This classical model is described by Rogers with Shoemaker (1971) and Rogers (1973).

In this paper, we argue that the agricultural extension model and the classical diffusion model, while historically related, are conceptually distinct. The agricultural extension model was a set of assumptions, principles, and organizational structures for diffusing the results of agricultural research to farm audiences in the U.S. This "model" actually was based on the experience of an agency that diffused agricultural innovations, and that agency's program of activities (Figure 1).

In contrast, the classical diffusion model evolved from social science research, and dealt theoretically with how innovations diffused over time within a social system. The main tenants of the classical diffusion model were not limited to farm audiences, nor to agricultural innovations, even though the early diffusion research dealt, rather coincidentally, with such systems and with this type of innovation.

So the main difference is that the agricultural extension model evolved from a particularly successful change agency, while the classical diffusion model derived from empirically-based, theoretically-oriented survey research studies.

The agricultural extension model has been widely copied in non-agriculutral fields, as a means of diffusing research-based

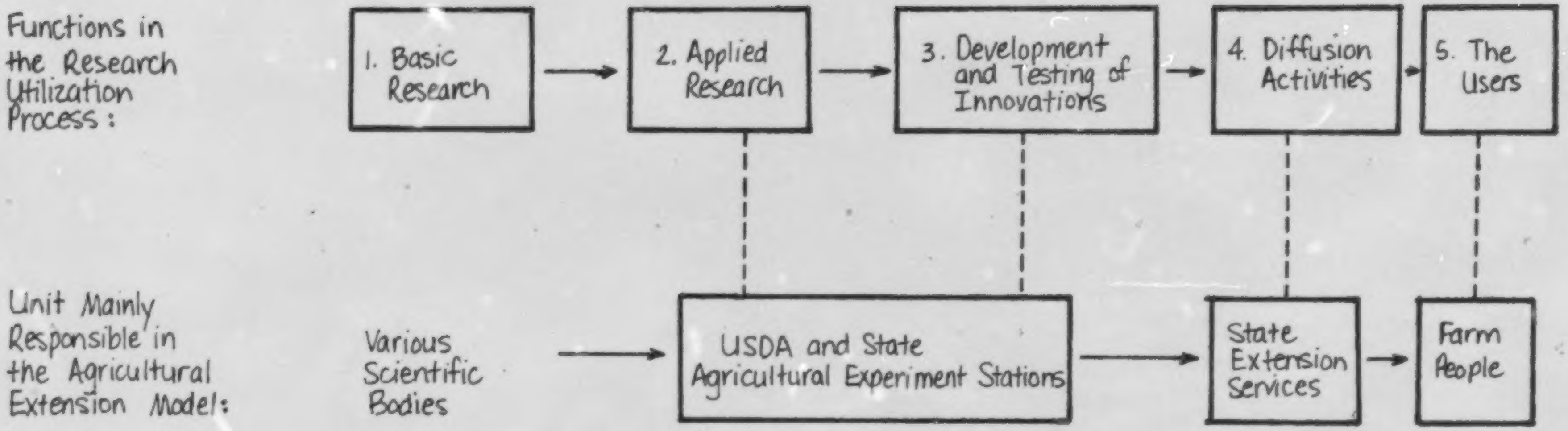
Functions in the Research Utilization Process:
1. Basic Research
2. Applied Research
3. Development and Testing of Innovations
4. Diffusion Activities
5. The Users
Unit Mainly Responsible in the Agricultural Extension Model:
Various Scientific Bodies
USDA and State Agricultural Experiment Stations
State Extension Services
Farm People

Figure 1. Functions in the Research Utilization Process and Correspondences with the Units in the Agricultural Extension Model.

information to potential users. Many of the 43 Federal technology-transfer programs in existence today show such influence (Committee on Domestic Technology Transfer, 1975). Few of these extensions of the agricultural extension model, however, have been analyzed in order to determine the transferability of the agricultural extension model.

In this report, we shall focus especially on five areas to which the agricultural extension model has been extended by national governments.

1. To the Social and Rehabilitation Service (SRS) in the U.S.
2. To the U.S. Office of Education (OE).
3. To agricultural extension services in developing countries.
4. To family planning organizations in developing countries.
5. To private industry in the United States.

Before we discuss such extensions, however, it is important to understand in detail, just what the agricultural extension model is and what it has done.

THE AGRICULTURAL EXTENSION MODEL

The Cooperative Extension Service was created by Federal law. Its purpose, as expressed in the creating legislation, is to "...aid in diffusing among the people of the United States useful and practical information...and to encourage the application of the same." In order to understand the climate into which agricultural extension services were introduced, we review briefly the patterns of U.S. agriculture generally in the last 50 years, and the changes in these patterns which many observers consider to be consequences of the activities of the extension services.* The quantitative data on which these observations are based are summarized in a series of 38 charts (see Appendix). These data should be interpreted with care; any data collected over a long time series are subject to possible error, to changes in the methods of collection and definition of variables, and to lack of comparability between different sources. The general trends are probably valid, and are frequently quite striking. To simplify interpretation, most of the charted data cover the same time period (1920 to 1970, at five-year intervals).

General Trends in Rural Life

The population of the U.S. has been increasing approximately geometrically, although at a varying rate, during the 50-year period of our present interest. The total population has approximately doubled, from 100 million to 200 million; however, the part of the population residing on farms has declined both absolutely and relatively. From about 31 million, or about 30 percnet of the total population, the farm population has decreased to about 10 million, or about five percent of the total U.S. population. The rate of this decline has been fairly linear (see Chart I), with the sharpest drop coming after 1950.

This decrease in the rural population has not resulted in a drop in total agricultural activity, but it has shifted the focus of that activity. The total number of farms has declined sharply from 1920 to 1970, from over 6,000,000 to less than 3,000,000 (Chart II). This decline has affected all types of farming operations, with the sharpest decrease coming in the so-called "general" commercial farms (those producing a mixture of products for the market rather than being primarily devoted to a single activity such as corn, cattle, tobacco, etc.). General farms once made up about a quarter of the commercial farms (all those producing over $2,500 worth of products for the market each year), and now make up less than eight percent. The decline in non-commercial (personal and subsistence) farms is also marked.

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*The state extension services, together with the Extension Service (called the Federal Extension Service until 1970) in the U.S. Department of Agriculture (USDA), constitute the Cooperative Extension Service.

One of the trends which agricultural analysts have noted most strongly over this 50-year period is the increasing dominance of U.S. agriculture by the large-scale operations known as "agribusinesses". These operations are sometimes divisions of primarily non-agricultural corporations, and sometimes are devoted to vertical integration of the agricultural sector itself (from growing to processing to selling the product).* Data on agribusiness farming activities is not easy to accumulate, partly because of the lack of a clearcut and widely-accepted definition of the concept itself and partly because of the traditional focus of agricultural data sources (the USDA and the U.S. Census Bureau) on the individual farm operation, rather than on the ownership pattern. However, some dimensions of the role of agribusiness in farming can be discerned. Chart III notes that despite the general decline in the total number of farms, the number of "managed" or "corporate" farms (categories not equal to agribusiness, but probably including most significant agribusiness farm operations) has remained fairly steady. It is interesting to note that the number of agribusiness farms remains relatively small; the "typical" U.S. farm is still an individual or family operation. Probably most "corporate" farms are in fact family-owned operations which incorporate for tax purposes.

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*For certain purposes it is possible to distinguish between agribusiness farming (that is, large-sized farms that are operated like a business corporation) and non-farm agribusiness (that is, devoted to supplying farmers with agricultural inputs and/or marketing farm products).

Over our period of interest, the total amount of land in farms has increased very slightly (Chart IV), reaching a peak in 1955. The total acreage in managed farms has followed this trend generally. However, as Chart V shows, the average managed farm is substantially larger than the average farm, and its size has increased more rapidly. The concentration of land in farms is a natural function of the decline in the number of operations coupled with the maintenance of the same total acreage; the average farm in 1970 is nearly three times the size of the average farm in 1920.

The most striking feature of agribusiness today is its relative dominance of the economics of farming. Managed or corporate farms tend to be very capital-intensive (Chart VI), with an average value nearly six times that of the average U.S. farm. This difference is partly accounted for (1) by larger size, although as Chart VII notes, the land is on a per acre basis less valuable than the average, and (2) by a greater investment in technology. Although agribusiness ("managed") farms are about 1.2 percent of all farms and 8.8 percent of the acreage, they use 11 percent of the total expenses of investment. Despite their large share of total farm acreage, they incur only 3.6 percent of the total crop failures.

Agribusinesses do not dominate all sectors of agriculture equally. In 1969, corporate farms produced one-third of the cattle, 30 percent of the turkeys, 24 percent of the vegetables, 22 percent of the fruit, and 21 percent of the chickens produced. On the other hand, they produced less than 3 percent of the milk and dairy products, pigs, corn, wheat, soybeans, and tobacco. This selective concentration partially explains the larger acreage of corporate operations--greater size being associated with cattle ranching in particular.

The economic revenues from farming are quite unequally distributed. While corporate farms make up only 1.2 percent of all operations, they account for 14.1 percent of the total farm products sold. While only 12.8 percent of all farms sell more than $100,000 worth of products annually, 67.4 percent of corporate operations do so. Many corporate operations are among the 50,000 "large-scale" farms, selling more than $1,000,000 annually. These operations account for only 3 percent of all commercial farms, but have 19 percent of the land and 34 percent of the sales of farm products. Clearly, then, U.S. agriculture is increasingly in the hands of larger operations, among which the corporate "agribusiness" operations have an extremely powerful position. The highly unequal distribution of revenues from farming, together with an increasing level of investment required to support farming operations, has created a number of social problems which we shall consider later in this report. For now, it is sufficient to note the continuing trend over this period toward greater concentration of operations and the tendency for the larger and more rewarding operations to be corporate rather than individual activities.

One of the most striking features of U.S. agriculture in this period (1920 to 1970) has been its marked increase in production and productivity (Charts VIII, IX, X, XI, XII, and XIII). There are several possible ways of looking at this trend. The U.S. Agriculture Department's index of total agricultural productivity (Chart VIII) illustrates the relationship between the value of several different classes of inputs (labor, materials, capital, ets.) combined and total market value of the outputs (crops, livestock, etc.). This index has risen substantially over the 50-year period. When the index is decomposed into its components, however, other patterns also become evident. Almost all of the change in the general index (output over input) can be accounted for by the growth of the output function, or demand for products; the input function has remained remarkably stable. Within the input function, however, there has been a drastic rearrangement of the components. The labor component is barely a third of its value in 1940, and the other components have increased in importance accordingly. This relationship (Chart IX) illustrates that the major shift in the nature of the production functions in modern U.S. agriculture is toward greater capital intensity.

The increasing substitution of capital for labor in agriculture is illustrated by two additional indices. The index of farm output per man-hour (Chart X) illustrates the increasing efficiency of the utilization of workers' time, and is related, partly as cause and partly as effect, to the decline in farm population noted earlier. The total number of persons both at home and abroad supplied with farm products has increased nearly fivefold in the 50 years from 1920 to 1970 (Chart XI). This increase reflects demand, production, and efficiency changes together, and is difficult to interpret directly in terms of any one of them alone.

The most effective way to measure agricultural productivity directly is in terms of the amounts of specific products produced by a given quantity of land. As this yield goes up, we can say unequivocally that we are seeing increases in productivity which cannot be attributed to demand factors. Two products which are commonly used for such indices are corn and cotton. While the yield for any particular year reflects specific factors (such as weather) as well as the long-term trend, the general trends are clear in both cases. Corn yields are nearly four times what they were in the 1920's (and they had remained about the same since such statistics were first collected in 1888, until 1920) (Chart XII). Cotton production shows the same trend (Chart XIII). In short, there have been increases in both basic productivity and in demand for agricultural products, which, when combined with the increasing substitution of mechanical tools for labor, have resulted in a vastly increased efficiency of production.

While the per capita income of the farm population has increased sharply, paralleling a general trend in the country (Chart XIV), it still remains substantially lower than that of the non-farm population.* The gap between farm and non-farm populations is somewhat smaller in 1970 than it was in the 1950's. This trend reflects in part the diminished number of people left on farms. The farms which people leave are generally those producing the smallest incomes, and the effect of this departure is thus to change the shape of the farm income upward.**

Farming has become an increasingly expensive proposition over the years (Chart XV). While gross farm income has shown enormous increases since the recovery from the agricultural depression of the 1920's and 1930's, net income has shown relatively little increase following the general readjustment after World War II. If these figures are converted to constant dollars (Chart XVI), this failure to increase since 1945 becomes an absolute decline in total net income (it should be noted that this income is being distributed among an ever-decreasing number of farm operators which accounts for the increases in per capita income). The increasing gap between the two curves reflects the enormous growth of the total expenses of farming. The increases in productivity and labor effeciency, clearly, have not come cheaply.

There are few very striking trends in the relative importance of the various components of the expenses (Chart XV). Most components have simply grown proportionately; the only major component to have shrunk noticibly is the wages paid for farm labor--which is to be expected from our previous examination of the labor component of productivity. The biggest increases are in feed costs and in depreciation, or capital equipment costs.

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*These figures are personal income, and do not reflect income to corporate owners, although corporate managers' personal incomes are included.

**Specific income distribution figures are not available for most of our time period, but the figures for 1959-70 indicate that this is the general pattern.

In general, then, the U.S. farm situation since 1920 (that is, during the major period of agricultural extension work) has been characterized by a decreasing farm population, the increasing concentration of land into larger holdings, emergence of corporate "agribusiness" farming as a major economic factor in the market, a general decline in subsistence farming, rising income for those left on farms but even faster rising expenses, and a considerable increase in agricultural production and labor efficiency.

The causes of these phenomena are multiple and interrelated and almost impossible to untangle. They are related to changes in the general economic and social structure of the country, as well as to factors operating in the agricultural sector alone. One pattern frequently described is that of "technological push"--a series of technical improvements in seeds, machinery, pesticides, etc., which increase the output of those who adopt them and make uneconomic the farming of those who for one reason or another do not adopt. While there are always new techniques forthcoming, and thus a constant technological pressure, after a certain point all those who are inherently resistant to technical change are likely to have been forced out of farming by those to whom the value of change is self-evident. The nature of the competition thus has both psychological and socio-economic dimensions, with an increasing emphasis on the ability of farmers to pay the costs of technology. Under this general explanation, both the increase in efficiency and output and the decrease in the number of farm operators can be attributed to the spread of agricultural technology.

It is outside the scope of this report to test the validity of this technological-push hypothesis. The present data do, however, indicate some trends which are coherent with the predictions of the hypothesis. We have noted that agribusiness farming increasingly dominated the profitable end of the farm income scale, and that such farms appear to use a disproportionate share of the technological advances in seed and chemicals. This trend is less observable in grain farming, where agribusiness farming is not so heavily involved. We noted that expenses for seed and livestock and for capital equipment have risen fastest among the various components of agricultural expenses; again, these are the areas in which technical innovations have been heavily promoted. Not all innovations are susceptible to adoption by all farmers; in the case of many innovations, a large-scale operation may be required in order to make adoption feasible. Sorting out the contributions made by individual innovations to the total agricultural picture is not possible. Further analysis aimed at understanding the relative contributions of various phenomena (specific innovations, changes in general farming practices, substitution of capital for labor, etc.) will be needed in coming to a final assessment of the "technological-push" hypothesis in relation to agricultural change.

However, the Cooperative Extension Service is based on the assumptions of this hypothesis; that is, the agricultural extension system was created to increase the rate of adoption of farm innovations. Thus an understanding of agricultural change in relation to the assumptions of technological push is necessary to appreciate the reasons for the development of the extension service system in the way it has evolved.

Historical Development of the Cooperative Extension Service

Both the USDA and the land-grant institutions were begun by legislation passed in 1862. The USDA had previously existed as a small part of the U.S. Patent Office. Several attempts to pass a land-grant college bill had been made previous to 1862, but these laws were consistently defeated by states' rights legislators who viewed the federal grant of land to the states as a threat to the states' power. In 1862, during the Civil War when the Southern states' rights enthusiasts were absent from Congress, the Morrill Act was passed quietly. This law provided that in each state an acreage of federal land was to be set aside for federal aid, and the income from this property was to support a college or university for teaching "agriculture and the mechanic arts". This legislation gave a tremendous increase in prestige to agricultural occupations, and the land-grant colleges have continued to do so since.

Actually, the Morrill Act was a general, vague, and ambiguously-worded document and its meaning was not clear even to Senator Morrill's fellow-senators. Historians suggest that this may have been deliberate. To gain the political support which would ensure its passage by Congress, it may have been designed to mean all things to all people. This lack of precision and clarity in the original land-grant college legislation has made it possible for these colleges to adjust and adapt to changing conditions.

Changes in the land-grant college complex over the years are presented in Charts XVII, XVIII, and XIX. While the system of 69 schools (17 of which are primarily black institutions, whose data are not included in the present tabulations) was virtually complete before the beginning of the cooperative extension program, these land-grant colleges have grown apace with the rest of the extension service. Separate land-grant college statistics have not been compiled since 1963, but up to that point, the enrollment in these institutions had increased eightfold since 1920, with the greatest increases coming in the areas other than technical agriculture and the "mechanic arts". As Chart XVII indicates, enrollment in agriculture programs has remained roughly similar to what it was in 1920, while "other" undergraduate programs--particularly in liberal arts and sciences, where the demand has been heavy--have expanded substantially. The overall growth in enrollment may be considered as a geometrically increasing curve, with a valley during World War II and a peak after it, when students who would normally have entered during the War years came into the institutions suddenly.

As the student population has increased, so has the average size of the institutions. Faculty and staff have increased by more than 12 times in the 43-year interval (Chart XVIII); data on faculty specialization are available only for 1920 and 1963, and show that the percentage of the faculty teaching agriculture decreased from 22 percent to 8 percent over these years, roughly paralleling the decline in the percent [illegible] students in agriculture (from 16 percent to 5 percent).

The income of land-grant colleges has also grown geometrically, and in recent years has tended to outpace the growth in income of U.S. higher education institutions generally (Chart XIX). In most cases, the original land-grants have long been converted to other forms of endowment; a major factor in the increase in income has been Federal grants for specific purposes. In general, then, the changes over time in the nature and emphasis of the land-grant colleges may be seen as closely related to the general changes in the agricultural scene and in the nature of U.S. society generally, which we have previously noted. Land-grant colleges, by decreasing their emphasis on their roots in agriculture, have managed to survive the general de-emphasis of agriculture in contemporary American society while maintaining their central role in mass higher education.

The early professors of scientific agriculture in the land-grant colleges soon realized that they lacked sufficent research-based knowledge about agricultural topics. This realization caused a demand for agricultural research on farm problems in agronomy, animal breeding and nutrition, horticulture, and other fields. The Hatch Act of 1887 provided federal funds to state agricultural experiment stations. These research centers developed in most states as an adjunct to the land-grant college of agriculture. The director of the experiment station is responsible only to the dean of agriculture, the university president, and the state government. The USDA annually reviews the research projects in each state to ensure that they meet federal stipulations. An average of about one dollar out of four spent at the state experiment stations is of federal origin.

The enormous increase in the funds available for publicly-supported agricultural research is shown in Chart XX. The state share of the costs of supporting the experiment stations has grown faster than the federal contribution (which has itself increased ten-fold since 1930). The biggest growth has been in research directly managed or funded by the USDA. It is only in the last four years that a reliable system for describing the activities funded by the cooperative research effort has been implemented; thus, changes over the years are extremely difficult to assess. Chart XX describes the recent breakdown (for FY 1973) of research activities into the nine standard USDA "goal areas"; of these goals, the first three are concentrated in technical agriculture, the second three in marketing and economics, and the last three in the quality of rural life. The first set of goals accounts for about two-thirds of the total research budget, and the second and third sets each have about one-sixth of the total. It is clear that "hard" agriculture continues to dominate the research carried out by public agricultural agencies, although there has been a major increase in the latter two sets of goal areas in recent years.

The relative proportion of total federal effort devoted to research, and to the "research delivery system" (that is, the extension services), is presented in Chart XXII. Since 1920, the USDA has invested a relatively constant proportion of the research funding (between 40 and 60 percent) to the "delivery", or extension, effort.

One may compare the scope of public research activity with the research activities of related to agriculture private industry (Chart XXII). Detailed figures are available on private research expenditures only since 1956, and then only in industry aggregates. However, some trends over this time period may be compared. Since 1956, the rate of growth of federal agricultural research spending has been fairly linear. It has almost exactly parallelled the trends for the food processing industry and the chemical (including agricultural chemicals) industry. The machinery industry (including agricultural machinery) has a much higher level of investment in research, but a not dissimilar trend line.

One customary measure of the proportion of activity devoted to research is to compute R&D expenditures as a "percent of sales". There is no exactly comparable measure for public agencies, but it may be approximated by computing research expenditures as a "percent of the total appropriations received by the U.S. Department of Agriculture". Using this measure (Chart XXIV), federal agricultural research is comparable to industrial practice, ranging from about 3 percent to 4 percent of "sales". It is also interesting to note that despite minor fluctuations, this percentage has remained quite stable over the 15-year period of these data, across all industries. The food processing industry devotes significantly less of its revenue to research than other industries, even those with an agricultural component. This is hardly surprising, since a large part of the public agricultural research is devoted to improving food processing technology. Clearly the agribusiness industry has a stake in continuing public agricultural research activities.

Need for an Agricultural Extension Service

In the early 1900's the state extension services were established as another addition to the land-grant colleges and universities. Starting in 1914, the Smith-Lever Act provided federal grant-in-aid funds to each state for extension purposes. The extension workers in each state are staff members of the land-grant college or university. The state extension services work closely with the college of agriculture teaching personnel and the experiment station research workers. In about half of the states, the dean of agriculture at the land-grant college is responsible for classroom teaching, the experiment station, and the extension service. In other states, there may be a separate director of the extension service, but he usually works closely with the dean of agriculture.

How did the extension services begin in the U.S.? The historical development of the extension service is closely related to that of the Farm Bureau, tracing from the formation of the first county Farm Bureau in 1911 for educational purposes. This relationship continued through the growth of the county agent movement during World War I, until the original county Farm Bureaus became state and national legislative pressure groups. Extension service-Farm Bureau relationships were severed soon after the formation of the American Farm Bureau Federation in 1919 in some states, but not until 1954 in Iowa and Illinois.

The early professors of agriculture in the land-grant colleges wanted their research-based knowledge to be used by farmers. But until about 1914, there was no effective means of transmitting such information from the colleges at Ames, Lansing, Davis, Raleigh, Ithaca, and elsewhere, to farm audiences. This was an era of social experimentation in finding effective means of reaching farmers. For instance, the agricultural professors wrote bulletins aimed at farmers, but many could not read or understand them, and there was no effective system for their distribution. Special campaigns were organized around a train-load of college professors who would tour their state to stump local communities in favor of some agricultural innovation, like seed corn selection in Iowa. Their knowledge was often received eagerly, but follow-up was lacking, and eventually the "corn seed gospel train" approach fell into disrepute. Lastly, agricultural improvement societies were formed in local communities to promote agricultural innovations among the gentleman-farmer class. Their main forums were county and state fairs, which provided some welcome rural entertainment, but much less effective agricultural diffusion. During this period of experimentation, a variety of piecemeal approaches to effective diffusion were tried, and all found wanting. The agricultural extension model was not yet on the scene.

Although there had been some type of agricultural extension agent in several counties in the U.S. prior to 1900, the first large-scale attempt at an extension approach was pursued in the rural South (especially Texas) around 1903, when a hundred or so local agriculturalists were employed to diffuse boll-weevil control methods to cotton farmers. But once the menace from these pests had passed, the extension agents were disbanded.

Credit for the first extension approach of a lasting nature, and in the format still largely followed today, usually is accorded Broome County, New York, in 1911. The Binghamton Chamber of Commerce in Broome County was concerned about the welfare of local farmers, as agriculture was the main local industry. Accordingly, the Chamber's "Farm Bureau" (so named in accordance with such other divisions of the Chamber of Commerce as the Roads and Alleys Bureau, the Protection Bureau, etc.) decided to employ a recent agricultural graduate from Cornell University to diffuse innovations to farmers in the County. Part of his salary the first year was donated by the local Delaware and Lackawanna Railroad, and so he was called a "county agent", as all railroad employees were termed "agents" in those days (for example, "ticket agents", "station agents", etc.). The Binghamton Chamber of Commerce's Farm Bureau included several leading farmers, and they solicited their neighbors for small donations to help pay the county agent's yearly salary. Soon these donations were institutionalized into annual memberships in the Farm Bureau.*

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*As Miller (1973, p. 9) noted: "The earliest county agent encountered two difficult obstacles...The first was how to win approval from local people in attempts to change traditional farming practices. The second obstacle...was the need for financial support. Of considerable help were sponsoring committees, which consisted largely of businessmen and prominent farmers, to be later termed Farm Bureaus".

Note that even at this early date, the agricultural extension service exhibited:

1. A basis in the felt need for a more rapid diffusion of agricultural innovations.

2. Strong local control over the professional change agent by an organization of farm leaders.

3. Responsiveness to local elites among their client system.

The idea of a county agricultural agent, and of a local Farm Bureau, spread rapidly across the U.S. after 1911. This movement was spurred (1) by provision of federal financing through the Smith-Lever Act of 1914, and (2) by the need for higher agricultural production during World War I.

The year 1919 marked the turning-point in extension service-Farm Bureau relationships. As the county agent movement spread, so did the Farm Bureaus, as the county agents' sponsoring body. Soon the county Farm Bureaus federated into state organizations, and then in 1919 into the American Farm Bureau Federation (AFBF). This organization immediately began to operate as a legislative pressure group, a function incompatible with its original purpose of being the local sponsor of the county extension agent. So the division of the Farm Bureau and the extension services began in 1919, although the two have remained friendly until this day. The legislative assistance of the AFBF, and state Farm Bureaus, is one reason for the financial strength and stability of the state and federal extension services.

The growth of the amounts of money and personnel invested in the agricultural extension effort since 1920 has been striking.

Although federal financing of extension did not begin until the Smith-Lever Act of 1914, as we have noted, by 1920 there were already over 3,000 employees of the extension services. By 1970, the total had reached over 15,000, with the rate of growth recently tapering off somewhat (see Chart XXV). We will comment on the components of the increase in personnel as we discuss the changing functions and organization of the extension activity in later sections. The number of *agricultural* agents has increased relatively little since 1935, despite the increases in extension service personnel as a whole.* This trend may relate to the extent of coverage of U.S. counties with agents; by 1935, virtually all the 3,150 counties in the nation had at least one agent (as early as 1920, about two-thirds of them were covered).

Funds for extension services come from a variety of federal, state, and local sources under matching arrangements and through several different appropriation accounts. The growth of the federal share has been almost exponential, a rate of growth generally characteristic of federal spending (Chart XXVI). Over the years, the share of the appropriation devoted to federal administrative expenses (the Extension Service in the USDA) has been fairly constant, even as the total appropriation multiplied many times.** This pattern is similar to that of many other federal formula grant programs in education and other fields. Not until the late 1950's and 1960's was there major growth in the administrative sector at the federal level.

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*Many of those currently called "agricultural agents" are actually 4-H Club workers; the separate classification for youth personnel was abandoned in 1960.

**For analytical purposes, it would be useful to have estimates of the share of the Cooperative Extension Service budget going for administrative infrastructure versus program costs. Unfortunately data on the administrative costs in the state extension services were not available. However, it was possible to determine that of the 17,000 total extension service staff in 1975, 1,350 (8 percent) were administrators or supervisors; 175 of these were in Washington, D.C.

Part of the increase in extension service funding can be attributed to simple inflation. However, even when the expenditures are reduced to constant dollars (Chart XXVII), a pattern of increase remains evident. Although the current federal extension appropriation is more than four times that of 1950, the real program increase is only about two times the 1950 level.

It is a measure of the popularity of the Cooperative Extension Service that it has managed to maintain a high level of growth at a time when federal spending on agriculture generally has not kept pace. The relationships between the different budgets involved (in millions of dollars) are as follows:

Date	Total Federal Outlays	Federal Outlays for Agriculture	Federal Outlays for the Cooperative Agriculture Extension Service
1940	$9,589	$1,580 16.5% of total budget	$19 1.2% of Agricultural budget
1970	$196,588	$6,201 3.2% of total budget	$130 2.1% of Agricultural budget

Agricultural spending has increased by nearly four times in this 30-year interval, but total federal spending has increased by over 20 times the 1940 level. Federal spending for extension is about seven times its 1940 level, while its share of the agriculture appropriation has nearly doubled. Thus not only has the program increased its real appropriation; it has also increased its proportional importance in the total federal effort devoted to agriculture.*

Although it is fairly easy to describe the size and scope of the extension service program, determining its impact on its target audience is a much more difficult task. There is no common set of figures for the entire period of our interest; in fact, for much of the 50-year period, there are no estimates of the direct impact of the extension services on national agriculture. Cooperative Extension Service has always been a decentralized program, with primary management at the state level; accordingly, much activity data has never been aggregated at higher than the state level. In the last few years, a national reporting system has been instituted which reports the number of extension agent "contacts" with groups and individuals. The most recent figures (for FY 1973) are summarized in Chart XXVIII. From these data, it is not possible to determine how much attention extension personnel currently devote to individual farmers and to agribusinessmen, respectively. However, technical agriculture now accounts for less than one quarter of all extension contacts. These contact data illustrate the major shift in extension service activity from "hard" agricultural technology to other types of know-how.

These "contact" figures do not allow us to determine how many individuals are served by the extension services; there is a great deal of multiple contact with some people. Not since 1950 has the extension service attempted to determine the number of individuals contacted; the figure at that time was estimated at about 7,000,000, of whom about 2,000,000 lived on farms, but these figures were based on extremely shaky estimates. At the present time, it is simply not possible to be very specific about the make-up of the total audience for the extension services. When the new computer-based USDA reporting system becomes fully operational in a few years, more searching analyses will be possible.

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*In fiscal year 1975, the total budget of the Cooperative Extension Service was $450 million with 40 percent from federal funds, 40 percent from state sources, and 20 percent from county governments.

Illustrative of the shift in the clientele for the Cooperative Extension Service is data over time for one part of the extension program--the youth division, or 4-H Club program, as described in Chart XXIX. Since 1960, the number of youth involved in formal 4-H Clubs has been declining, but 4-H has developed a number of special-purpose activities which have enabled it to continue growing in total youth contacts. The residence of 4-H Club members (Chart XXX) and the nature of the "projects" Chart XXXI) which they undertake has been changing in recent years. Since 1948, the percent of 4-H youth residing on farms has been slipping steadily, although at a slower rate (40 percent) than the rural population generally (49 percent). In 1948, 4-H Clubs had no operations in urban areas; at present, about one-third of 4-H enrollees are urban residents. The types of projects undertaken confirm this trend away from a purely agricultural focus; in 1948, animal and plant science projects accounted for about half of all projects, but now account for less than one quarter. Projects in "community development", unknown as late as 1957, accounted for nearly 20 percent in the late 1960's, although they have since slipped somewhat.

To summarize the data on the development of the extension services: The extension service program has had a more or less constant growth, combined with a change in emphasis away from purely technical agriculture toward subjects of interest to urban audiences as well. The extension service apparently has attempted to maintain itself as a "change agency" organization, even though the nature of the changes it seeks to stimulate have changed over time as the nature of U.S. agriculture has changed. The reasons for such a shift are complicated, but a major explanation lies in the mechanisms which the extension service developed to keep in touch with changes in its clienteles. We now turn to a review of how these changes came to be sensed and managed by the Cooperative Extension Service.

Local Control and Needs-Orientation

At the county level, the county extension agent needed a local body to replace the Farm Bureau as his organizational tool for conducting educational activities. So he formed a county advisory board, composed of 15 to 25 local leaders, that typically met with him on a monthly basis.

The extension service has such a local policy-making group in most U.S. counties. This group, with the county agent, decides the nature of the extension program each year. It also helps develop the budget for the extension service in the county, and may have some influence in the firing and hiring of the county agent.

The county agent operating with a needs-oriented philosophy has two different reference groups, and differences between them may cause him a certain degree of personal conflict. One reference group is the extension bureaucracy in which he works, personified by the district extension director who is the county agent's direct boss. Another important reference group for the county agent is that of local power-holders among his county farm clientele. The divided loyalties of the county agent are illustrated by the following case study (Preiss, 1954, p. 236):

> F.L. [the county agent] unenthusiastically organized a county [extension] agricultural advisory council at the behest of the state extension office, but he felt it was unnecessary in the county. It took months to get organizations to designate representatives, and it was hard to find meeting times when a majority could or would appear. The sessions themselves were strained and awkward, since many council members were curious about each other, and preferred to operate via old accustomed channels. After a few unproductive meetings, F.L. decided the group was too unwieldly, and ceased to schedule any more. He knew the state office was disturbed by this outcome, but felt he had made a genuine effort to make the organization work. He believed its failure was not his fault, but was simply due to the impracticality of the idea at the county level.

In most counties, however, county extension advisory groups operate quite smoothly, and with the full support of the county agent. They provide a means of obtaining client participation in the planning of extension service activities. For instance, if local farmers have much concern about the ecological problems caused by insecticides and fertilizers, they will see that this topic is featured in the county agent's activities in the year ahead. And the county extension agent, dependent on client interest for the success of his diffusion efforts, is naturally inclined to be very attuned to farmers' needs.*

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*In reality, much of the county agent's annual program is determined by state administrators and extension specialists. Rice (1974, p. 127) estimates that 90 percent of U.S. extension programs probably originate at the state level rather than in the local community, but the professional philosophy in the Cooperative Extension Service is still that of farmer self-determination.

The county extension advisory groups can also initiate a bottom-up request for agricultural research. For instance, perhaps they find that there is little scientific knowledge about the ecological consequences of insecticides. The county agent will convey his request for information to his state agricultural university, and if it cannot be answered with existing research-based knowledge, the state agricultural experiment station may initiate a research project on this topic. While such "extension in reverse" certainly occurs, the actual cases of such needs leading to new research projects are probably few.

The advisory councils also provide feedback to the state level, and directly to the county extension agent, as to the adequacy of previous diffusion efforts and of research activities.*

Naturally, the members of county advisory councils are hardly typical farmers; instead, they are often highly specialized, well-educated, and relatively innovative. So there is an elite bias in the membership of the county advisory groups.

Rise of the State Extension Specialists

Actually, of the 15,000 professional staff members at all levels in the extension services, only about 6,300 are county-level extension agents (Chart XXV). Almost every county in the U.S. has an agricultural agent (who is usually also the county extension director, or administrative chief of the county-level employees), and about 80 percent of the counties have a home economics agent. A considerable number also have a 4-H Club agent, and/or marketing agent.

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*In addition, the advisory councils lobby locally for financial contributions to the extension budget. Previously, we indicated that about 20 percent of the total funds for the Cooperative Extension Service comes from county governments.

What do the other 8,700 professionals who are not county-level agents do? Some are administrators or supervisors at district, state, and federal levels (Figure 2 provides a typical organizational pattern). As Chart XXV shows, there are currently about 1,000 administrative personnel in the Cooperative Extension Service.*

In addition, there are at present nearly 4,000 extension subject-matter specialists at the state level. These specialists attempt to interpret current research findings in their particular field to the county extension employees and thus eventually to the extension clients. The development of the specialist group was slow; between 1925 and 1955, there were never more than 1,500-2,000 specialists. Since 1955, as Chart XXV shows, there has been a considerable expansion of this specialist corps. Over two-thirds of the specialists are still in agricultural fields, but much of the expansion in recent years has come in non-agricultural fields. The rapid growth of the specialists coincides with the diversification of the extension service program and its audiences, as well as changes in the nature of agriculture.

How do extension specialists relate to the rest of the extension system? Consider an extension agronomy specialist. His office is in the department of agronomy at the state agricultural college, and hence he is a colleague with the research and teaching faculty in his specialty. He travels out over the state to address farmer meetings and to keep county extension agents abreast of new developments in agronomy. Likewise, there are extension specialists in farm management, marketing, rural sociology,

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*About 1,300 multi-county "area" agents, who work on such topics as agriculture and marketing, are not broken out as a separate category in Chart XXV.

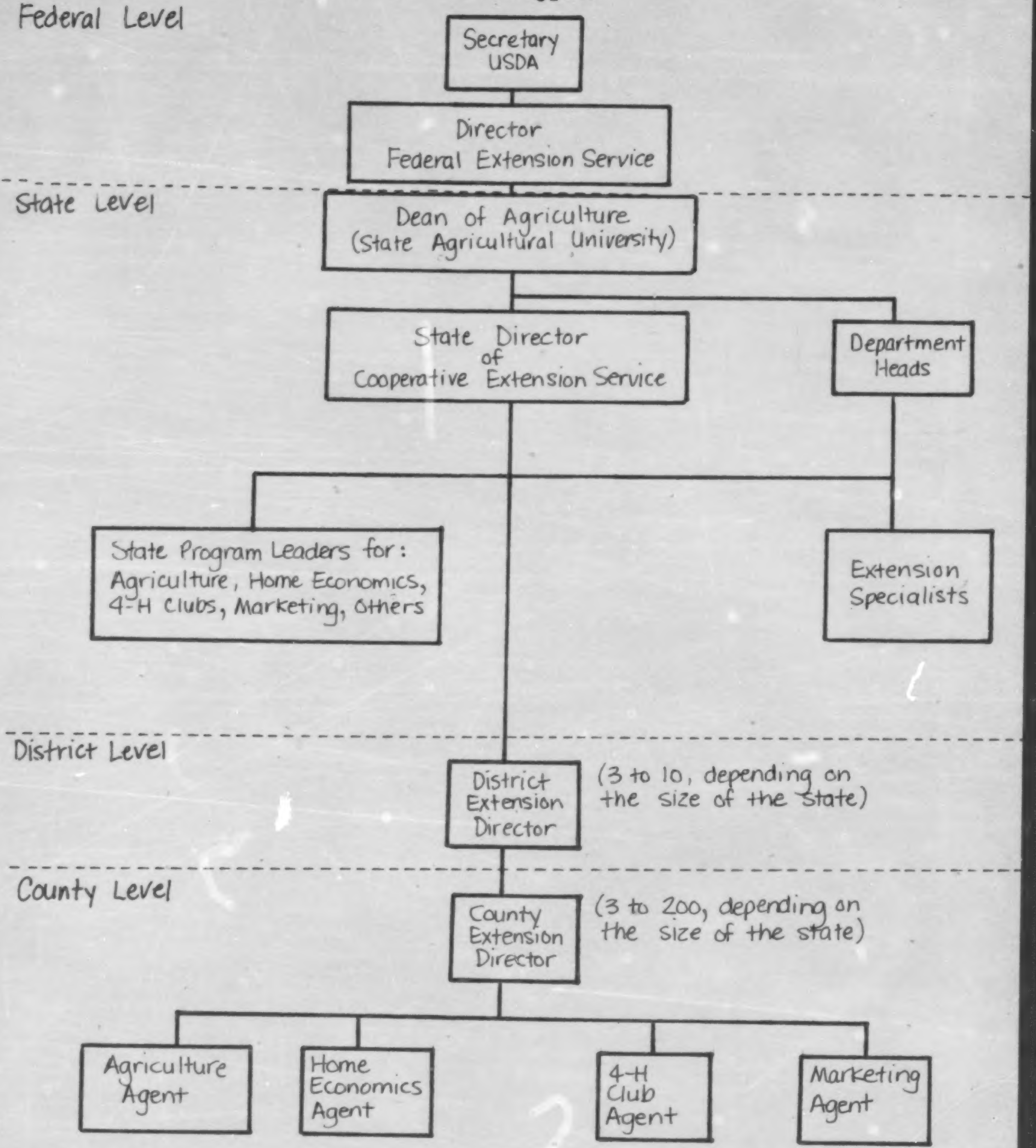
Federal Level
Secretary USDA
Director Federal Extension Service
State Level
Dean of Agriculture (State Agricultural University)
State Director of Cooperative Extension Service
Department Heads
State Program Leaders for: Agriculture, Home Economics, 4-H Clubs, Marketing, Others
Extension Specialists
District Level
District Extension Director
(3 to 10, depending on the size of the state)
County Level
County Extension Director
(3 to 200, depending on the size of the state)
Agriculture Agent
Home Economics Agent
4-H Club Agent
Marketing Agent

Figure 2. Organization of the Cooperative Extension Service in the United States.

Source: Axinn and Thorat (1972).

animal husbandry, poultry husbandry, home economics, and other fields. There has been a trend for the number and importance of extension specialists to increase as the nature of farming became more specialized.

Essentially the specialist links the sources of research-based knowledge to the county extension agents. He is the county agent's county agent. In order to effectively fill this linkage function, the specialist must be able to bridge the scientific/intellectual system of the state agricultural university with the pragmatic world of the farmer and his county agent. Usually, the specialist has had previous experience as a county extension agent, and then moved, through graduate study, into a specialized agricultural field. About half of the extension specialists have Ph.D. degrees, and many of the rest are doctoral candidates on a part-time basis. This high level of scientific training is necessary for the specialist to be able to understand research publications, and to decode their contents into language that the county agent and his farmer-clients can understand.

The success of the extension specialist rests directly on how well he can serve the needs of his clients, as judged by the number of county agents who invite him to address local meetings, the number of requests for the bulletins that he writes, etc. If the specialist cannot relate his knowledge to farmers' problems, his career is short-lived.

Similarly, the reward system for research workers in the U.S.D.A. and the state agricultural experiment stations strongly encourages finding research results (and publishing them in a form) that are useful to farmers. For example, one agricultural experiment station evaluates each of its researchers annually with a point system in which great weight is placed on farm magazine articles and on farmer bulletins. Clearly if a scientist wants to succeed in this system, he must address his efforts to applied research problems, and specifically to finding information that is needed by farmers. This pressure toward research utilization facilitates the work of the state extension specialist in cooperating with his research and teaching colleagues in his academic department. All are pulling together toward producing utilizable knowledge, and in getting it diffused and adopted by farmers. Were agricultural research activities not oriented toward potential utilization, the linking function of the extension specialist (and the county agent) would be much more difficult.

The development of extension specialists did not begin until after 1920. Part of the reason for evolving such a corps of specialists lay in the increasing specialization of surviving farms in producing only a few products. We noted earlier the decline in "general" or unspecialized farms and the increasing dominance of specialized commercial farming, particularly among the large and profitable farms (almost no general farms are currently found in the top economic classes of farms used by the U.S. Census Bureau). This specialization among surviving farms increased the need for more specialized information from the extension agents about recent technical advances. For example, while previously each U.S. farmer had owned about 200 chickens, by the 1950's most U.S. farmers had no chickens, and a relatively few poultry-producers dominated the industry. When one of these poultrymen with perhaps 100,000 chickens in his operation asked his county extension agent a technical question about poultry nutrition, the county agent was unlikely to be able to supply the answer. But the state extension specialist in poultry nutrition probably could.

Further, as private non-farm agribusiness firms like farm machinery companies, feed and seed firms, and agricultural chemical companies came to play a more important role in U.S. agriculture, extension service employees (especially the extension specialists) began to cooperate more closely with these agribusiness firms. So the poultry nutrition specialist mentioned above might be called on for assistance by chicken feed companies in St. Louis, Minneapolis, or Chicago. And a change in one of their poultry formulas might affect hundreds of thousands of farmers, and millions of birds. Extension specialists were more likely to be asked for such assistance by agribusiness firms than were county agents, because of their greater technical expertise in specialized areas of agriculture.

Thus we see how the specialization of U.S. agriculture helped create a need for extension specialists; the extension model was hence adjusted to cope with an environmental change in the nature of agriculture.

Broadening the Subject-Matter of Extension

In 1911, the sole content of extension activities was biological agriculture: Agronomy. Animal Husbandry. Botany. Zoology. Genetics. Poultry. County agents placed their main emphasis upon production technology like new seeds, fertilizers, and farm equipment.

But soon, the farmer's wife began to demand that her information needs for better nutrition, child care, and home management also receive attention. Accordingly, the county agricultural agent, usually with a college degree in technical agriculture, was given a county-level colleague in the form of the home economics agent, usually with a bachelor's degree in home economics from a land-grant college. During the 1930's, this group expanded rapidly (Chart XXV); they now make up about one-quarter of all extension personnel.

Soon thereafter, the county extension staff was further expanded to include a county agent responsible for 4-H Club activities. This 4-H Club agent usually possessed a bachelor's degree in technical agriculture, and was considered a future county agricultural agent in training. After five to seven years as a 4-H agent, he might be promoted to agricultural agent.

By the 1930's and 1940's, many agricultural leaders began to see that agricultural production technology was only a part of the picture. What good were production-increasing innovations when U.S. agriculture was faced with a farm surplus? Accordingly, state extension services turned some of their attention to problems of agricultural marketing, and to consumer information programs. Some counties, especially those with large cities, began to feature extension marketing agents on their staffs, and state specialists in marketing were appointed.

All of these changes marked a trend in the extension services away from strictly an agricultural production focus, to the addition of subject matter content in the social sciences related to agriculture. The neat model describing the flow of biological agriculture innovations from researchers to farmers (Figure 1) did not seem so appropriate for the non-biological content. For one thing, the state agricultural experiment stations moved only slowly and partially into social science research. Further, the research results, once available, usually were not embodied in a material innovation. Often only an idea was involved. Further, clients' needs for non-biological agriculturally-related knowledge were less strongly felt, and less focussed.

The shift away from sole dependence upon biological agricultural content also meant that the extension service appealed to new audiences: Rural-nonfarm people, agribusinessmen, suburban dwellers, and even city residents. The feeling persists at the present time among many extension employees that the agency should only work with farm people. The Smith-Lever Act of 1914 that provided federal aid to the state extension services did not spell out very clearly whether extension employees should carry on their educational programs only with farm people, only with rural people, or with everyone in their county. Since the Act did not specify that the extension service should work only with farm people, there has been an increasing trend to work with urban and rural non-farm audiences in recent years--a trend which we have already noted in our earlier review of extension service contacts (Chart XXVIII). The shift in the nature of activities which this shift of audiences implies--which we saw previously for 4-H projects (Chart XXXI)--represents a major change in the nature of extension work as it had traditionally been practiced. Such a shift called for many new skills.

This change from a sole emphasis on agricultural and homemaking production technology was resisted by many extension workers. The extension service undoubtedly has changed more slowly than has the audience served by the agency. The early emphasis upon production technology was institutionalized in the extension service; most extension employees are trained primarily in technical agriculture or in home economics.

Recent special programs in the extension service reflect a change from "things" to "people", a shift from an exclusive production philosophy to include a focus on diverse social problems. The development of the 4-H "special interest" clubs and the special projects which we noted earlier as composing the major thrust of the 4-H program in recent years (Chart XXIX), illustrate how far this change in focus has progressed. Of the 16,000 man-years of extension time reported by USDA for extension workers in FY 1973, only 6,000 were devoted to agriculture specifically, the remainder being divided between home economics, youth activities, and other functions. The new demands on the extension service system put new pressures on the abilities of the extension agents to communicate their knowledge effectively--a challenge to which the extension service has tried to respond.

Process over Content

The first county extension agent in Broome County, New York, in 1911 was a graduate of Cornell University in technical agriculture. It was assumed that if the county agent possessed an adequate grasp of the subject-matter content of agriculture, he could easily learn to master the process of communicating this message content to his farmer clients. This assumed priority of content over process continued from 1911 until about the mid-1950's.

The turning-point in the evolution of process over content in agricultural extension occurred with the launching of the National Project in Agricultural Communication (NPAC) in 1954. This ad hoc organization was headquartered at Michigan State University, and sponsored by the USDA and the state agricultural extension services, in cooperation with the American Association of Agricultural College Editors.* NPAC was launched in answer to extension agents' needs for in-service training in the behavioral science aspects of human communication. They felt that they were lacking in how to communicate their technical know-how to farmers.

NPAC activities consisted (1) of developing training materials for agricultural extension agents on the topic of communication and change, (2) of testing these materials with limited numbers of extension agents, and evaluating the results,and (3) of training over 5,000 county extension agents, state extension specialists, and extension supervisors and administrators. NPAC was a big push; its five-year budget was over $1.1 million.

The NPAC training was conducted in a whirlwind campaign. First, two trainers from each state extension service came to NPAC headquarters in East Lansing for two weeks of training in human communication and change. Films and other training materials were then provided to each pair of trainers for them to use with all of the extension staff in their state. In short order, all 5,000 extension employees in the U.S. were trained in communication. The training courses were tremendously successful, mainly because they provided knowledge and skills on a topic for which most extension staff felt a strong need.

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*These editors were found in every state extension service headquarters; their main task was to publish agricultural bulletins, produce radio programs, and generally to encourage the use of mass media channels by extension agents.

By its termination in 1960, NPAC had received rave notices from most extension workers. The chief of the Extension Service said, "I have never seen any other program which met with as quick and unusual acceptance by the states, with as few kicks." The Director of the Indiana Extension Service stated: "Most effective innovation in extension in my experience...Indiana extension is sold 100%...By far the most important influence in creating an entirely different attitude among our staff toward their work. Supervisors say agents [are] doing a better job" (NPAC, 1960).

The lasting effect of NPAC on the Cooperative Extension Service was to emphasize the importance of social science training, especially concerning the diffusion process. After NPAC training, almost every extension agent in the U.S. grasped the nature of diffusion; he saw himself as a "change agent", and thought in terms of innovators, laggards, opinion leaders, and stages in the innovation-decision process. It was almost as if extension workers had suddenly found a theoretical model to guide their activities. In a way, they had. The classical diffusion model had merged, at the operational level, with the agricultural extension model.

And even though NPAC ended in 1960, its considerable influence continues to this day in the mainstream of extension philosophy and policies, through in-service training courses, and in the self-conceptions of extension agents. While state extension services continue to employ as professionals only agricultural college graduates in agriculture and home economics, a major emphasis in in-service training is upon the process of human communication and behavior change.

Rise of the Aides

All extension agents were professionals, holding at least college degrees in agriculture or home economics, until 1968. It was assumed that technical competence based on professional training was fundamental for earning a high level of credibility in clients' eyes.

The federal "war on poverty" programs during the 1960's were originally concentrated in urban core areas, although about a third of all U.S. poor lived in rural areas. By the late 1960's, there was much pressure on extension services to use their educational efforts to solve rural (and urban) poverty problems. After initial resistance to this thrust, the availability of additional federal funds to the extension services for this purpose led to the rise of extension aides.

The aide approach was implemented through an operation called the "Expanded Food and Nutrition Education Program" beginning in 1969. By 1973, this program had reached nearly 900,000 families, of whom about 305,000 are currently enrolled. Nearly two-thirds of these families are from minority groups. At the end of 1973, there were some 7,600 aides working in 1,226 separate projects--during the program as a whole, nearly 22,000 persons had served as aides. While the original impetus for the program came from urban areas, a major focus of its development has been in rural non-farm areas and suburbs. At present, 85 percent of the projects are in areas of less than 50,000 population (although 60 percent are in areas of greater than 2,500).

The low-income aides were an adjunct to the county home economics agent, designed to provide home visitors to low-income housewives on a regular and intensive basis. The aides were selected from among this client audience, given a brief in-service training and close supervision, and required to make a regular schedule of home visits. As the title of the program implied, the original objective of the program was to improve the nutritional status of poor families; the aides were officially called "extension nutrition aides". In practice, the problems of their clients could not be so easily categorized and separated from each other, and the aides have sought to provide information on whatever felt needs they encountered: Family planning, how to become eligible for welfare payments, child discipline, budget management, etc.

Typically a county home economics agent might have 15 to 20 aides working under her direction, directly led by two or three aide-supervisors. The aides are drawn from the local community, and unlike many extension professionals, often are members of the minority groups that they serve. Many work in urban areas, where home visiting does not require automobile transportation.

The aide approach, widely used in other federally-sponsored war on poverty programs with the urban poor, recognized that in addition to credibility based on professional training, trustworthiness could derive from a high degree of socio-economic similarity with clients.* The aides could "talk the clients' language" in a manner that the home economics extension agent could seldom do.

Not unexpectedly, the aide approach was often resisted by agents,** and to date it has been confined exclusively to the home economics area and even there insulated from the regular program by its status as a separate "program" with its own directorate. The aide approach is more than just another activity, as it reflects a major shift in the agricultural extension model: From profession-orientations to peer-agents, from rural to urban audiences, and from elite needs to a social problem focus. It is probably the most significant change in the agricultural extension model since its formation in 1911. The rise of the aides in the state extension services is a major alteration in the model, reflected and embodied in the thousands of inner-city, black, and low-income aide-employees.

Criticism of Extension

Despite the general image of success usually attached to the agricultural extension model, it has had detractors and critics since its origin. Some criticisms were directed at its elite bias, its continued emphasis upon agricultural production in the face of farm surpluses and a decreasing farm population in the United States, and its close friendship with the American Farm Bureau Federation.

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*Competence credibility is the degree to which a communication source is perceived by receivers as being technically expert; safety credibility is the degree to which a communication source is perceived by receivers as being trustworthy.

**In almost every field, professional change agents are highly resistant to the employment of para-professional aides.

But certainly the strongest critique was published in 1972 under the ingenious title of Hard Tomatoes, Hard Times: The Failure of America's Land Grant College Complex. The author, Jim Hightower, something of a Ralph Nader of agriculture, has headed a Washington-based organization called the Agribusiness Accountability Project. The book's title derives from a specific research project at one state agricultural experiment station that bred new tomato varieties to facilitate machine-picking, an innovation of particular advantage to large-scale tomato farmers. The book's theme is that much of the tax-supported agricultural research at state agricultural universities is designed to serve the needs of agribusiness corporations and the largest commercial farms. The state agricultural university-extension service complex is a closed system, Hightower claims, whose priorities are set through interlocking relationships of elite farmers and agribusiness firms, with little voice for the interests of the environmentalist, consumer, family farmer, or rural poor. For instance, of 6,000 scientific man-years employed by agricultural experiment stations in 1969, only 289 were devoted to "people-oriented" research to improve rural living standards (Hightower, 1972).* According to him, the main responsibility for the

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*Hightower's figures are based on an earlier classification scheme for research than that which we discussed previously, and are thus not strictly comparable with those presented in the present report.

"hard times" of U.S. agriculture is due to the overblown reputation of the land-grant-college-and-research-establishment and its continuation in an era where socio-economic conditions differ considerably from those of 1911.

While Hightower's critique conforms to few of the rules of traditional social science research methodology, his study does form an effective example of what is often called policy-oriented advocacy research, and perhaps is more applicable, in many cases, than the more standard sociological exploration of similar phenomena (Nolan and Galliher, 1973). His basic assumptions are clear, and condition his assembly and analysis of data. This enables him to avoid the ambiguity of conclusions which a more inclusive treatment might have led him to. His work is further distinguished by a sincere faith that the resources currently devoted to the agricultural research and extension establishment would be more effective if redirected to other problems. It is at least questionable, however, whether the social problems which he correctly identifies as central to rural American life today are in fact amenable to solution through social research. The central value of Hightower's critique is that it raises questions about the assumptions held in agricultural research and extension rather than simply assuming a basic coherence of values.

Hightower's argument raises important questions about the criteria for success of the agricultural extension model. Undoubtedly the extension services have played an important part in increasing the productivity of U.S. agriculture, especially in the period since about 1940. But extension services have not greatly assisted rural people in coping with the consequences of the agricultural revolution that they helped unleash.

Hightower's critique need not be limited just to the Cooperative Extension Service in the U.S. The policies and activities of most development agencies can be analyzed in terms of two criteria, which are often in conflict. On one hand such programs want to improve farm incomes. This goal usually calls for concentrating development efforts on the larger farmers. In this way, one obtains economic growth.

On the other hand, such programs of change also seek to help those clients who may need help the most: The poorest and least innovative farmers. This goal calls for redistributing farm incomes, by bringing up the levels of the smallest farmers. So these two goals are often in conflict: Growth versus equity. In order to achieve balance in these objectives, some degree of coordination is needed between the various agencies involved in development programs in a nation.

Raising the levels of income by working with large farmers brings about a change in per capita income, and hence contributes to development. Additionally, a more equal distribution of incomes and levels of living may be desired.* However, seldom can both objectives be achieved by the same development program.

Presumably public resources are allocated in a program of planned change; the agency chooses alternatives that will best fulfill social objectives. It can be argued that agricultural development of small farmers requires the most resources and time (per farmer), and offers the least immediate overt results. Extension services in the U.S. placed their emphasis on immediate concerns, such as the diffusion of innovations to large farmers. Such activities show the most rapid overall gains with least expenditure. So most extension services tend to help the larger farmers and pursue a levels-raising goal, rather than helping the smaller farmers through redistribution goals (Rogers, 1973b). "The notion that the poor can be helped by aiding the rich must be abandoned" (Dorner, 1972). The degree to which this phenomenon represents what has been accomplished in U.S. agriculture is difficult to assess, because of the shortage of income distribution data (to which we referred earlier). However, the evidence cited in Charts II and VIII points in the direction of rapid growth at the expense of equity.

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*A shift from growth to equity in the intellectual paradigm of development has occurred in rural development programs in Latin America, Africa, and Asia, dating from about 1970 (Rogers, 1976).

So in an aggregate sense, the extension services really have not helped farmers as a sector, if judgments are based solely on the rate at which they have passed out of farming. At the same time that the extension services may have contributed to the technological push which phased so many farmers out of agriculture, other federal agencies have labored to help young farmers enter the occupation (such as vocational agriculture programs that provide high school training to future farmers, and the Farmers Home Administration that gives credit and management advice to young and low-income farmers), and to stay in it (such as the Agricultural Stabilization and Conservation Service that seeks to control farm surpluses and thus buoy up agricultural prices).* At the federal level, all of these agricultural agencies are headquartered in the U.S. Department of Agriculture (it is not unusual to find large Federal agencies trying to achieve opposite purposes at the same time).

Critics of the extension service point out that while it has sought to raise average levels of farm income, it has done so in a way that redistributes incomes toward greater inequality. Many of the other federal agricultural agencies have just the opposite priorities: To increase the equality of farm income distribution, rather than to raise total agricultural production.

The Effects of the Extension Services

Development of clear causal connections between the agricultural extension service effort and the changes in the agricultural sector which we have noted earlier is not a simple task. In a specific case, such as an innovation like hybrid seed corn, some assessment of quantitative results may be possible (Griliches, 1958). For the extension services generally, there are simply too many factors involved for us to isolate them and interrelate them successfully.

We noted earlier the general hypothesis of a "technological push" which relates changes in agriculture to technological improvement and thus to the extension service effort which spreads that improved technology. While we cannot subject this hypothesis to a direct causal test, we can note trends in the relationships between the factors we have indentified. We have already commented on the substantial decline in the rural population--the original audience for the extension services--and the continuous trend of the extension program to expand its funds and personnel. The substitution of new audiences for old ones is a result of this trend. An examination of the number of farms per extension agent is illuminating (Chart XXXII). Even for agricultural agents, the decline is striking, from about 2,700 farms per agent in 1920 to less than 500 in 1970. The average farm acreage per agent has decreased less sharply, from 400,000 acres to about 182,000 acres--due to the increased size of farms. Determining an "optimum" number of farms per agent would certainly have to take into account the relative size and complexity of their operations and of the technology to be communicated--a task with many inconclusive dimensions and virtually no relevant data.

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*Especially in the 1930's the Cooperative Extension Service began a running battle with the Farm Security Administration (the predecessor to the Farmers Home Administration) over just this issue of growth versus equity (Rice, 1974, p. 62).

Measures of the scope of services provided by the extension program are complicated by the shortage of comparable data from different time periods. It is possible to construct some proxy measures, however. One such measure is the "constant dollar cost per extension employee". If we assume that most of the change in the salary for a given position may be attributed to allowing for the effects of inflation, then an adjustment for constant dollars removes this effect. The cost per employee includes both salary costs and the cost of all the supplemental services other than individual time which the extension service provides. Therefore, the constant dollar cost per employee includes a fixed component for the individual salary, and the trend in the line should indicate the trend for supplemental services. This trend (in Chart XXXIII) is generally upward, with a sharp decline in the World War II period. By this measure, the extension program is now providing total services which cost three times as much in constant dollars as they did in 1920. This assessment does not, however, consider the effects of these services or their value to the recipients.

The investment in extension services per farm (Charts XXXIV and XXXV) is another possible measure of the scope of assistance provided. The generally exponential shape of the curve is readily predictable from a combination of the linear decrease in the number of farms and the geometric increase in extension service program costs. Again, the return on this investment is difficult to assess. Quite possibly, one could demonstrate that each farm gets at least $50 worth of benefits from the extension service each year; however, special research would be required to look into this question more precisely. The per capita cost of the extension program in constant dollars to the people of the U.S. has increased sharply from 7¢ in 1920 to about 55¢ in 1970 (Chart XXXVI). Again, the degree to which this cost is offset by benefits cannot precisely be determined on the basis of existing data. We currently spend a smaller portion of our total income for food than previously (although, in constant dollars, we spend a larger amount of money for food, a result perhaps due to increased consumption and higher processing and middleman charges).

Perhaps the fairest assessment of the extension program is to consider its relationship to basic agricultural productivity. Certainly there are many factors other than extension inputs involved in productivity increases. However, it may be possible to assume that there is a fairly constant component of such increases which may be attributed to extension service activities. Calculations based on this assumption are summarized in Charts XXXVII and XXXVIII; it appears that costs are not substantially higher today (in constant dollars) for the extension service inputs to increased corn productivity than in earlier years. Under this productivity criterion of extension service effects, no diminution of the effectiveness of the extension effort is evident, despite the large increases noted earlier in extension cost per farm and per agent.

It should be emphasized again that the relationships drawn between extension activities (inputs) and farm productivity outcomes are by no means causal statements. The data to test causal hypotheses are simply not available without considerably more basic research on the relevant relationship functions than is at present available. A generally positive set of associations have been observed thus far. It would be at least as correct, as Hightower (1972) does, to correlate extension activities with rural depopulation and demoralization, the increasing concentration of land and capital in a relatively few agribusiness hands, and the decline in taste and nutritive quality of our mass-produced food--and at least as incorrect to attribute causality. Ultimately, the effects of the extension services make themselves felt in extremely complicated ways. Perhaps it is not necessarily important for purposes of this report to be able to make unequivocal statements about the "effects of the extension services on U.S. agriculture". What is important is to see how the extension program has changed, how agricultural and social patterns have changed, and how the two sets of changes have interacted to create the image of the extension service as an effective and cheap way to diffuse technical knowledge in agriculture. Hand-in-hand goes the need to explain the ambiguities of that experience and the special, unreplicable circumstances which have conditioned that evolution.

Overview and Summary

The history of the U.S. agricultural extension program does not divide itself neatly and paradigmatically into a series of evolutionary stages. Rather, it represents a gradual alteration of the pattern of systematic interrelationships between technology creators, interpreters, and users. Before presenting our conclusions about the U.S. experience with agricultural extension services, it is appropriate to review briefly how these interrelationships have changed.

When the extension service began, it formed a linkage between the producers of agricultural technology and the users of these innovations, who were predominantly independent operator-clients. The extension agent (the linker) for the most part carried his information in his head or in some immediate references. Agricultural technology was not particularly shaped by client demand, since there were in the early stages no mechanisms for feeding back such demands into the research system. Thus the information flow in the early extension service system was first to the county agent, during his university training in agriculture, and thence from him directly to individual farmers.

This relatively simple system soon became modified with the inclusion of feedback systems to guide agricultural research into directions which county agents could identify as areas of immediate concern to their clients. The provision of large new amounts of public money for agricultural research stimulated the production of new technology, and created the demand for extension service subject-matter specialists to form a new link between the county agent and the technology-generating system. The pattern thus became one in which the county agent formed a link between the farmer-client and the extension specialist, and so another layer of interpretation was created between the client and the system.

Meanwhile, forces were acting to change the nature of the client group. The general depression in agricultural prices which lasted through the entire period between the two World Wars exerted strong economic pressure on farmers, and drove out those whose operations were only marginally profitable. Those farmers who survived were those who could accumulate capital and land and take advantage of the new technology which the extension agents were making available. No data exist to judge the degree to which the county agents were offering technology that was accessible only to the wealthy. However, in practice it was those who could afford to adopt these innovations who remained in farming, taking over the land of those who could not. In some cases, land fell into the hands of corporations, either pre-existing or formed for the purpose, largely because of the superiority of the corporate form of organization in the accumulation of the necessary capital base. Thus the nature of the client group for the extension services underwent a slow and partial shift, away from the individual entrepreneur and toward the corporate farmer, many of whom had independent access to agricultural technology. In many cases, then, the local extension agent found that the most sucessful farmers no longer needed him as a conduit for agricultural technology; they preferred to reach directly to the universities and thus form their own links with researchers.

The county agents, in turn, began to discover other demands for their assistance from rural non-farm people and, ultimately, from urban audiences. As the bounds on their audiences became looser, the nature of the information which they had to dispense became more and more widely dispersed, and the need for the extension specialist as intermediary between the researcher and the agent, more striking. Specialists in more diverse areas were required. The permissable subject-matter of the extension services underwent a radical broadening; the effect was to require a more complicated research and backup system.

At the same time, there was no slackening of the demand for further advances in agricultural technology. The strongest demands came, as might be expected, from the most articulate and best-organized farmers (partly through their pressure group, the American Farm Bureau Federation). What these larger farmers demanded was, for the most part, more capital-intensive technology, which offered the highest returns for the capital they had to invest. The effect of this concentration of extension service activities on capital-intensive agriculture was, of course, to leave the poorer farmer even more disadvantaged, since the extension agent did not have much to offer him. This process, in turn, increased the exodus from the farms, and encouraged the increasing concentration of the most productive farming operations in the hands of corporate structures.

At present, the extension agent is a multidimensional conduit for a wide variety of technology to a wide variety of audiences. His original audience, the independent farmer needing technical expertise, is becoming extinct. The need for change-agentry in its original missionary sense has largely disappeared, at least in relation to the farm audience, although it remains an extension service preoccupation for the new, poor, urban audiences.

Thus the agricultural extension services have undergone major changes of focus. Today, there is no one "agricultural extension model"; instead there is a consistent set of assumptions and philosophies about technology generation, transmission, and communication, and a constantly shifting set of administrative arrangements, priorities, and operating systems within this framework. The extension system has displayed remarkable persistence and ability to restructure its relationships as conditions changed, and this adaptability may be its most striking and important aspect.

Conclusions

In this review of the development of the Cooperative Extension Service in the U.S., we have noted a number of different stages in the development of the system and a number of consistent elements which appear at different stages in different form. To summarize our review, we present here an outline of these elements and how they have changed.

We believe there are eight main elements in the agricultural extension model, which we state in general terms so that these elements can be used to analyze other research utilization systems in our summary of the various cases we review:

1. A critical mass of new technology, so that the diffusion system has a body of innovations with potential usefulness to practitioners.

2. A research sub-system oriented to utilization, as a result of the incentives and rewards for researchers, research funding policies, and the personal ideologies of the researchers.

3. A high degree of user control over the research utilization process, as evidenced through client participation in policy determination, attention to user needs in guiding research and extension decisions, and the importance accorded feedback from clients on the system's effectiveness.

4. Structural linkages among the research utilization system's components, as provided by a shared conception of system, by use of a common "language" by members of the system, and by a common sense of mission. Such internal linkage between researchers and users must be maintained over time.

5. A high degree of client contact by the linking sub-system, which is facilitated by reasonable agent:client ratios and by a relatively homogenous client audience.

6. A "spannable" social distance across each interface between components in the system, in which the social distance may reflect levels of professionalism, formal education, technical expertise, and specialization. Generally, these variables decrease in degree as one moves from the research sub-system (where Ph.D.'s are usually employed), through linkers, to the client sub-system.

7. Evolution as a complete system, rather than the research utilization system having been grafted on as an additional component of an existing system.

8. A high degree of control by the system over its environment, and thus the system is able to shape the environment rather than passively reacting to changes in this environment. Such a system is less likely to face unexpected crises or competitors, and usually can obtain adequate resources. The degree of control is expressed through the system's power base, its perceived legitimacy, and its amount of political-legal influence.

Table 1 details how these elements have coexisted at four general stages in the evolution of Cooperative Extension Service.

We will return to these elements as a framework for analyzing other experiences with the extension model after our case reviews of these experiences. For now, the following generalizations may be offered about the agricultural extension model:

Table 1. Main Elements in the Agricultural Extension Service Over Time

Main Elements in the Agricultural Extension Model	Eras in the Development of the Agricultural Extension Model in the U.S.			
	Pre-Extension (1862-1910)	Institutionalization (1911-about 1925)	Growth (About 1925-about 1955)	Recent (About 1955 to the present)
1. A critical mass of new technology	Little; concentrated in the private sector	Growth of academic research base	Increasing specialization of research fields; start of the "agricultural revolution"	The "agricultural revolution"; federal funds for research reach about $300 million per year
2. A research sub-system oriented to utilization	Dominated by individual entrepreneurs/inventors (e.g., farm machinery inventors)	Utilization focus kept by researchers with farm backgrounds	Development of reward system to encourage research translation into practice	Reward system continues to encourage utilization
3. A high degree of user control over the research utilization system	Farmer control exerted through the market for technology	Rise of Farm Bureaus at the local level	Farm Bureaus federate into a national pressure group, and are replaced as local program planning bodies by county advisory councils	Farmer participation in extension program planning continues
4. Structural linkages among the research utilization system's components	Linkages between land-grant colleges and agricultural experiment stations	County agents form linkage between farmers and researchers	Extension specialist role added to improve linkage between county agents and researchers	Researchers and specialists now linked to agribusiness firms, and through county agents, to non-farm audiences
5. A high degree of client contact by the linking sub-system	Little regularized contact of agricultural experts with farmers	County agents established in almost every county in the U.S.	Total number of extension staff triple during 30-year period from 5,000 to 15,000, while number of farmers decrease	Decline in county-level extension staff, while state specialists increase in numbers; about 500 farmers per extension agent

Table 1. Continued

Main Elements in the Agricultural Extension Model	Eras in the Development of the Agricultural Extension Model in the U.S.			
	Pre-Extension (1862-1910)	Institutionalization (1911-about 1925)	Growth (About 1925-about 1955)	Recent (About 1955 to the present)
6. A "spannable" social distance across each interface between components in the system	No effective contact between researchers and farmers	County agents link effectively with their farm audience	Extension specialists added in order to link county agents with researchers	Greater extension efforts on non-farm topics and audiences, but with less success than in technical agriculture
7. Evolution as a complete system	Little previous agricultural research until land-grant colleges and agricultural experiment stations are established	County agent established as a new linking sub-system	Extension specialists arise as another new part of the extension system	Extension continues along familiar lines of organization, but adds wider scope to program
8. A high degree of control by the system over its environment	Land-grant colleges enjoy public support	Involvement of local Farm Bureaus in supporting extension services; county agents have high credibility for farmers	Support for appropriations from AFBF (American Farm Bureau Federation)	Cooperative Extension Service given credit by public for the "agricultural revolution"

1. *The agricultural extension model has changed considerably since its origin in 1911, in response to alterations in its environment, and these adjustments are one reason for its relative success.*

2. *The agricultural extension model is based on client participation in identifying local needs, program planning, and evaluation and feedback.*

3. *Agricultural research activities are oriented toward potential utilization of research results, such as through reward systems for researchers, and this pro-utilization policy facilitates the linking function of the extension specialist and the county agent.*

4. *State-level extension specialists are in close social and spatial contact with agricultural researchers and professors in their specialty, and this facilitates their performance in linking research-based knowledge to farmer problems.*

5. *The agricultural extension model seems to have been more effective in diffusing agricultural production technology to farmers, than in its latter-day extensions to other subject-matter content, and to non-farm audiences.*

6. *The agricultural extension model now recognizes the importance of communication as a basic process-skill of change agents, and provides communication training on an in-service basis.*

7. *The agricultural extension model includes not only a systematic procedure for the diffusion of innovations from researchers to farmers, but also institutionalized means for orienting research activities toward users' needs; thus the land-grant*

college/agricultural experiment station/extension service complex is a research utilization system, including innovation-diffusion as only one component.

8. *If success is measured only by continued growth in size (in funds and personnel), the extension services have been highly successful due (1) to their ability to adjust to environment changes, and (2) to the strong support of the American Farm Bureau Federation, and to elite farm leaders*.

9. *The extension services' elitist orientations have invited criticism for a lack of concern with rural social problems, some of which resulted from the prior activities of the extension services in diffusing technological innovations in agriculture*.*

If the first county agent in 1911 could meet his contemporary counter-parts in Broome County, we wonder if he would recognize their activities as representing extension work. Low-income aides. Long distance phone calls to state extension specialists in Ithaca. Talk of laggards, opinion leaders, and the two-step flow of communication. Golden hamsters instead of baby beeves.

We doubt it.

Now we turn to the analysis of the seven cases of extending the agricultural extension model, and shift from our report's first objective of describing the agricultural extension model, and its effects on the agricultural revolution, to the second objective of analyzing its extensions.

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*More specifically, the activities of the extension services over the years have focused rather narrowly on immediate technical problems in agriculture, rather than on the longer-range social, political, economic, and ecological consequences of technological change in U.S. agriculture.

SOCIAL AND REHABILITATION SERVICE (DHEW) EXPERIMENT WITH RESEARCH UTILIZATION SPECIALISTS

The Social and Rehabilitation Service (SRS) is one of the two agencies within the Department of Health, Education and Welfare to have attempted a research utilization program based directly on the agricultural extension model (the other, as we shall see, is the U.S. Office of Education). The SRS was created in 1968 by merging the former Vocational Rehabilitation Administration (VRA), the Welfare Administration, the Administration on Aging, and several smaller social service programs, to improve coordination of income maintenance and rehabilitative programs. The first Administrator of SRS was Mary Switzer, formerly the head of VRA, who had strongly championed the rehabilitation approach in federal government. Under her direction the new Rehabilitation Services Administration (RSA), successor to VRA, continued to enjoy a large measure of autonomy, even though it was one sub-unit in SRS.*

Research authority and funding has been part of the vocational rehabilitation (VR) effort almost since its creation. However, research has never been closely integrated into the actual operation of the VR program. In comparison with the Cooperative Extension Service, VR is even more a state-operated program, with the federal role largely limited to funding and the setting of broad program guidelines. There are wide differences among the states in the operation of the VR program, the administrative arrangements, and the quantity and qualifications of staff. Federal research sponsorship has always rested in a central "research office" which related to the state-operated VR activities through the director of the VR program. The separation between the line offices administering VR programs and the staff office setting research priorities has apparently led to some questions about the "relevance" of research and the "utilization" of the research results.

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*It should be noted that SRS has been extensively reorganized since the experience reported here.

A complicating factor was the touchy political situation surrounding the VR program. Under Ms. Switzer, the program established a reputation as one of the few federal programs which in a sense "paid for itself" in terms of its contribution of trained (rehabilitated) people to the economy. This reputation was carefully cultivated through an elaborate reporting system in which "case closures" were the primary measure of success, and as a result of this strategy, the VR program consistently had support from all parts of the political spectrum in Congress. VR research funds over the years apparently were influenced by a sensitivity to Congressional interests on the part of the administrators. Thus research directions were not guided directly by practitioners' needs and problems.

Thus there emerged a large body of research findings relating to rehabilitation strategies and methods, for which no pre-established utilization procedure existed. At the same time, increasing pressures on state VR operations began to create needs for program improvement innovations, and the logical question arose as to how the research literature could meet these needs.

In general, the main conduit for such research-based information had been literature-searching by individuals in some state VR agencies. In 1966, following pressure on the federal VRA from a conference of state VR directors,* an "Office of Research Utilization" was set up in Washington, and publication of Research Briefs was established to précis some of the research literature into a more useful form.

The rather small steps toward research utilization were followed in 1968 by an experiment with "research utilization specialists" (RUS) in the state VR agencies. This effort, patterned explicitly on the agricultural extension model,** established nine pilot projects in state VR offices (one state was chosen from each of the HEW regions). Ninety percent federal funding was provided, with each RUS budgeted at from $25,000 to $50,000 per year (Backer and Glaser, 1974). Thus the total RUS operation represents about $2 million in federal and state funds over the five year period of experimentation. RSA guidelines for the RUS projects suggested that applicants should have at least a Masters' degree and two years of experience as a rehabilitation counselor at the operational level. Primarily, the new RUS's had been counselors and administrators on the staff of a state VR agency. Three of the new RUS's had

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*At this conference in December, 1966, much interest was shown by state and federal VR officials in the agricultural extension model.

**The 1968 Guidelines from the RSA creating the research utilization specialists began: "These Guidelines are based on research utilization experiences in fields other than rehabilitation, one of the early models being that of the County Agricultural Agent" (Hamilton and Muthard, 1975).

PH.D.'s.* Administration of the RUS program was deliberately left to the discretion of each of the nine states (an approach thoroughly consistent with the history of the VR program generally) to encourage experimentation with different organizational and operational systems.

In 1973 the Office of Research Utilization, together with the other research programs previously operated by the component agencies within SRS, was moved to the Office of the Assistant Administrator (SRS) for Planning, Evaluation, and Research. This centralization of the research function within SRS marked a continuation of the trend to separate research from operations, and gave added weight to the necessity to develop an effective utilization scheme.

An involved evaluation effort by Edward Glaser and Associates of Los Angeles (Glaser and Backer, 1973; Backer and Glaser, 1974; Glaser and Backer, 1975; Hamilton and Muthard, 1975) followed the nine projects, and forms the basis for the following review. A questionnaire to more than 1,500 rehabilitation professionals in the nine states was supplemented with field visits and document analysis.

Comparability between the state RUS projects is severely hampered by the enormous disparities between the projects in terms of client load, complexity of administrative machinery, and relative influence of the RUS function. However, a few consistent generalizations can be drawn from the RUS experience:

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*And had been high-level state officials in their VR agency, suggesting they may have possessed a high degree of organizational power, but not necessarily a firm commitment to organizational change.

1. The RUS's had to create their own sets of functions, dependent largely on their own relationships with the rest of the staff and the place within the hierarchy of the state organization where they came to rest. There was no "great groundswell" of need for their services which needed only to be tapped. On the contrary, the RUS's had to first find pieces of research to utilize, then work out a setting in which to utilize them. Their most successful activities were a series of such special "blue-ribbon" projects--two or three to a state--rather than an ongoing response to the felt needs of line staff for research-based information. Generally, the problem of gaining understanding and acceptance of their role as research-to-practice linkers continued to plague the RUS's.*

2. The "clientele" of the RUS were not the persons to be rehabilitated, but rather professional individuals in the administrative structure of the vocational rehabilitation agency. Thus, the RUS's were more like the extension specialist in the state extension services than the county agent. The RUS's visibility within their state agency had much to do with the impact of their research utilization function. Over the nine projects, 51 percent of the professionals surveyed had had some contact with their RUS (Glaser and Backer, 1975). This problem of visibility is particularly important since, as we noted earlier, it was largely up

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*In several of the nine states, the RUS's formed a project advisory committee of VR agency officials, which was considered helpful in gaining acceptance of their function (Hamilton and Muthard, 1975, p. 46).

to the RUS himself to identify needs which his research-based knowledge might be able to alleviate. It seems quite clear that staff members in state rehabilitation agencies are not trained to identify problems as "researchable" questions--the degree to which they are led to think of research as having problem solutions largely depends on presenting them with new, predefined programs based on research.

3. The greatest response was to RUS activities which improved the ability of the individual counselor (rehabilitation caseworker) to "close cases". Placement workshops in Massachusetts, paraprofessional training programs in New Jersey, and the like, were best received. In general, RUS projects which dealt with the expansion of services (particularly in Wisconsin and Missouri) were less popular. Research utilization priorities, which in the pilot framework appeared to be shaped primarily by what topics an individual RUS could get someone to listen to, are thus more responsive to immediate crises than to system-level growth and anticipation of future requirements.

4. As long as the RUS operation remained limited to a single individual somewhere in the state rehabilitation bureaucracy, the utilization of research findings was sporadic and limited by sheer availability of time, even if the administrative setting was congenial. In California, where the state VR operation employs a staff of about 1,300, the very existence of the RUS was known only in a narrow radius around the state headquarters in Sacramento,

and the RUS was faced with a rather hopeless client ratio.* Clearly, simply grafting a "research utilization" function into an otherwise unchanged system does not produce wide changes in organizational behavior.

5. In general, the experience with the RUS's did not justify all the early hopes for the new arrangement, although a number of real accomplishments were recorded. The RUS projects have, at relatively small cost, introduced some innovations into nine state VR operations, and may continue to do so in some cases. They have not generally succeeded in establishing routine access of these agencies' employees to the mass of rehabilitation research, or in creating a "research utilization climate". They have been about as effective as any small demonstration grant project in the areas which they have addressed (the so-called "blue-ribbon" projects), but that limited success has little to do with the deeper question of research utilization. Any state agency, if it has the funds, can always find one or two pieces of research to turn into demonstrations. Thus, the RUS activity in the SRS has not come to grips with the basic problem: How to bring the mass of research results together with a full range of agency problems.

6. There has, however, been enough payoff from the RUS effort to maintain six of the nine projects under state funding after the end of direct federal support in June, 1974. Only one of the state

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*The activities of each RUS was extended somewhat by his use of a microfiche reader and a microfiche set of the 2,000 final reports from SRS-funded research and demonstration projects; Backer and Glaser (1974) consider this use of an automated information system to be very helpful to the RUS's.

programs was terminated prematurely. The administrative arrangements have in most cases been substantially rearranged after the end of federal funds.

The roots of this discouraging experience can probably be traced to certain features of both the VR program generally, and to the specific implementation of the RUS strategy. First, over the years the VR program has built its reputation for success on its rate of case closures--that is, persons rehabilitated to productive life. The reporting system, which in some states is virtually a "closure quota" system, puts a high premium on rapid handling of each client case. Clearly, research aimed at identifying new classes of unmet needs will not be likely to find ready acceptance in such an administrative climate; any research which speeds the case closure process will be accepted, provided the already overworked counselor does not himself have to think the problem through. Given the nature of this demand structure, perhaps the "special project" emphasis of the RUS at the state office level is about the best variety of research utilization which could be expected.

Second, the fact that the RUS represented an "outside graft" onto the state structure, rather than an organic growth out of it, reinforced the separation of research utilization versus case closure priorities which we have noted previously. Extra federal dollars, even earmarked dollars, are usually welcomed by state agencies--but the traditions of federal project grants, and the methods of accounting for them, reinforce a pattern in which the "federal project" is seen as an activity separate from the normal run of state-level agency administration. A dynamic was set up between the regular staff and the RUS which implied that they were seeking separate goals--rather then moving toward a synthesis of purposes. This "ascribed conflict" in the position of the RUS put a very heavy strain on the personal resources of individuals occupying the position--a strain which was only in a few cases overcome.

Finally, the entire RUS project illustrates the weakness and slippage inherent in a system where research priorities are set at the federal level, largely in terms of system-wide needs, and utilization is sought at the state and local level, whose priorities may be quite different. Two separate hierarchies tend to have at least two separate sets of goals--and the separation between the hierarchies complicates the resolution of differences. To expect a single "linking-pin" research utilization specialist to overcome this discontinuity requires a substantial "leap into faith". It is to the credit of SRS that they sponsored an extensive and realistic evaluation of the RUS activity, and that the evaluation results were given wide attention by state and federal officials in the RSA and SRS.

However, in this case of the RUS in the SRS, the agricultural extension model in application seems to have foundered on a combination of organizational and administrative dynamics, conflicting priorities, and lack of a clear view of just what the role of the RUS was supposed to be.

So we conclude that despite some successes in introducing changes in state operations, the SRS experiment with research utilization specialists (RUS's) was a largely unsuccessful attempt to extend the agricultural extension model because it neglected certain elements in the model. The RUS approach started with a body of completed research, and tried to get it translated into use. It did not create a research utilization system.

THE U.S. OFFICE OF EDUCATION EXPERMIMENTS WITH EDUCATIONAL EXTENSION AGENTS

The U.S. Office of Education (OE) came to its research role much later than VRA, but with considerably more impetus. Until the late 1950's the OE was a very small group of subject-matter specialists, administering a few small programs of assistance to state education agencies (SEA's) for limited pruposes. The National Defense Education Act of 1958 marked the beginning of the growth of OE into a major organization, but it was not until the Elementary and Secondary Education Act of 1964 (ESEA) that the real shock occurred. In two years the agency quadrupled in size, and took over a whole new range of functions and powers of regulation and control in education.

Title IV of the ESEA created a new program of education research grants, and the OE reorganization of 1965 set up a Bureau of Research (BR) to administer this activity; it contained divisions of elementary education research, higher education research, vocational education research--in short, it was supposed to serve as the research arm of the other component bureaus of OE, which accordingly had no research programs of their own. The suddeness of the growth of this area, and the creation of BR, did not allow

OE to develop a fully rational plan for the effective utilization of its research funds. Instead, for several years BR was content to fund applications as they were received, since there were few resource constraints. By the late 1960's, with the beginning of federal funding cutbacks, BR moved to a "centers of excellence" concept, creating a set of R&D centers and 20 "regional educational laboratories" to orient research activities toward developing educational innovations. However, there was still no utilization plan, and relatively little monitoring to see what use was being made of the centers so created.*

One of the activities emerging from this period of retrenchment in the research function was a computer-based research cataloging system called "Educational Resources Information Center" (ERIC). Patterned on successful systems such as the National Library of Medicine, ERIC was seen as an information system to bring research results together in order to expedite a search process by users. It was essentially a passive resource, but it represented a step toward applying research results to particular areas; at least it made it possible to determine which areas and topics had been studied. The ERIC system was implemented through a series of 17 clearinghouses throughout the country, and was centrally managed by BR's Division of Educational Technology.

As BR's efforts began to be more closely scrutinized on utilization criteria in a period of declining resources, attention turned increasingly to ERIC--one of the most solid products of the whole educational research effort. While it was a resource of unquestioned value, it was clear that it was not being tapped to anywhere near the degree that it might be. The cost and effort involved for teachers to use ERIC simply was greater than they could afford. An evaluation survey of ERIC users in 1970 by Frey (1972) found that 62 percent of the users were college students. Only 21 percent of the users were teachers.

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*A useful review of the various research-to-practice linkage systems in the field of U.S. education is Butler-Paisley and Paisley (1975).

In 1970, the reorganization of OE broke up the old Bureau of Research, and ERIC became part of the new National Center for Education Communication. NCEC determined that a concentrated effort to increase the use of research resources should be tested, and accordingly began the "Pilot State Dissemination Project" in 1970--again, as in the SRS case, based explicitly on the agricultural extension model, even to the name "educational extension agents". From the beginning, the thrust of this approach was to increase the utilization of ERIC.

Educational Extension Agents

The effort was fairly small-scale, limited to seven areas in three states. Each area had a full-time "educational extension agent" assigned to it, who roamed through the schools in the area (one or more school districts) looking for teachers who had problems about which there might be research solutions. In each of the three state education agencies there was an information retrieval specialist (or group) who took the requests brought in by the local agents and searched the resource bank (primarily ERIC) for appropriate references. When appropriate information was identified, the agent would take it back to the requestor. The agents also played a variety of consultative roles, depending on their particular expertise. The most significant part of the experiment, however, was the use of the educational extension agents as intermediaries between the research banks and the potential users (that is, teachers). The goal was to avoid setting up an ascribed "expertise gap" between users and the information system.* Further, the agent/client ratio was much more reasonable than for the RUS's, with about five to ten school buildings and 100 to 200 teachers per agent.

As in the SRS program, the role of the "educational extension agent" was largely developed by the individual occupying the position, and each of the seven operated somewhat differently. In contrast to the SRS RUS's, the OE agents were not directly a part of the organization to which their services were being rendered--the OE "clients" were teachers and school administrators, while the educational extension agents were identified as SEA personnel. The educational extension agents' "authority" was thus consultive, and demanded a rather astute mixture of rational problem-solving and inter-personal relations to build appropriate working connections with the systems, schools, and teachers with whom they worked. What was needed was a degree of informal manipulation of the power structures in the local school systems; most of the agents became very adept at this ability during the experiment. This lack of official power was a positive factor in increasing the acceptance of the agents' service; not only were certain intraorganizational dynamics avoided, but the agents had to "try harder", rather than relying on the system to see them through. The right of the client to define his needs and choose his solutions meant that the educational extension agent was not held responsible for providing "bad information", and was an important factor in the teachers' acceptance of the extension agents (Sieber, 1973b).

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*In fact, Sieber (1973b) concludes that a crucial factor in the acceptance of the educational agents was their similarity in superior subject knowledge or organizational rank between the agent and the teacher-clients.

Like the SRS, OE deserves considerable credit for carrying out a full-scale evaluation of the project while it was under way (through the Bureau of Applied Social Research, Columbia University). It is by no means a usual pattern for demonstration programs in DHEW to receive so careful a review. The evaluation in the OE case was generally positive, indicating that the presence of the agents in the target areas had indeed led to a much greater utilization of the ERIC research bank than existed in non-target areas, and that the results of the service were generally satisfactory to the teacher recipients (Sieber, 1973a and 1973b; Sieber and Louis, 1973; Sieber and others, 1972).*

A number of specific guidelines for a fuller program emerged from the evaluation, particularly in terms of administrative and support arrangements. However, several key questions about the reasons for variations in utilization rates remained a mystery and resulted in uncertainty and debate about the likely success of an expanded version of the educational extension program. Because of this uncertainty, plans for a national expansion of educational extension agents, which were developed late in 1971, were shelved. A plan for a more modest experimental expansion of the system was developed in order to resolve key questions underlying the debate over its potential success as a national program. This experimental program was never implemented, apparently because of loss of key agency personnel and shifting agency priorities.

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*One federal official who was involved with this program suggests that the evaluations may have been less critical than deserved due to modest initial expectations about program accomplishments.

Departmental strategy in early 1971 called for services such as dissemination to be developed and financed by SEA's through revenue-sharing and other mechanisms, rather than through federal project grant funds. The experience with revenue-sharing to date, however, does not indicate that innovative programs such as an extension-network are often implemented by SEA's which are hard-pressed by competing demands for revenue-sharing funds from established programs. Until 1974, the notion of a national educational dissemination system remained a good idea whose time had not yet come. We shall shortly describe the National Diffusion Network Program that eventually emerged in 1974-76, and show how it built upon some of the experiences gained in the earlier attempt at educational extension.

Comparison of the Educational Extension Agents and the RUS's

What are the features of the educational extension program which led it to a degree of success, rather than to the general disappointment of SRS's RUS program? We have already noted that the inability of the agents to rely on their "official position" to establish their role required them to develop a network of unofficial relationships which proved a basis for the development of collegial working relationships. Moreover, the prior patterns of inter-organizational relations reinforced this developing relationship, in contrast to the staff-line conflict which we noted with the RUS's. One of the traditional roles of the SEA vis-a-vis local school systems has been the provision of technical research advice and consultation, and the presence of the educational extension agents could be seen simply as a more effective means of carrying out this traditional function. In short, the basic value of the service being provided was mutually agreed upon by all parties before the arrangement began.

Not only was there agreement on the general principle involved, but the educational extension agent was more oriented to a "response to user needs" than was the RUS approach. In fact, one of the evaluator's criticisms of the educational extension agent program was that it remained almost exclusively responsive, and made little effort to "diagnose" problems and to help actively in the definition of needs. This in spite of the fact that the OE program began with an "increase-the-use-of-ERIC" motivation. By operating in this responsive mode, the OE extension agents enjoyed a high level of acceptance among their clients. The RUS's, on the other hand, were often seen as running around with a bag of research results trying to find someone to push them onto, an approach not endearing to already busy professionals.

Several observers, including those who conducted the formal evaluations, commented that a major departure of the educational extension agent program from the traditional agricultural extension model is that the potential "adopters" of research results were in the educational case located in organizational rather than individual settings. Teachers are organized in schools, while farmers act mainly as individuals. Thus organizational dynamics enter into the adoption decision, as well as individual criteria. While this organizational aspect is involved to a degree, it is certainly the case that the educational extension agents operated in a climate far closer to that of the agricultural extension model than did the RUS's. Many research findings in the educational area can be utilized effectively by an individual teacher; relatively few needs which surfaced through a mechanism such as the education extension agents required system-wide action to implement an innovation. On the other hand, almost all of the VR research with which the RUS's had to work required system-level activity; very little was within the power of the individual VR counselor to accept or reject. The RUS could thus hope at best for a few major successes; the educational extension agent could look for a large number of small successes (that is, innovation-adoptions), which, after all, is closer to the goal of research utilization and more parallel with the agricultural extension situation. The agents were able for the most part to avoid the problem of "multiple goals" which plagued the RUS effort.

In a peculiar sense, the lack of clear research planning in the original educational research effort may have made it easier to utilize the results, than in the case of the more prioritized VR system. Leaving the topics to be researched primarily to the interests of the researchers led to considerable concentration on individual classroom experimentation, rather than the more difficult school system-level analysis. As we have seen, it is primarily for this classroom-oriented research that most opportunities for utilization exist. Thus the body of research with which the educational extension agents had to deal was at the outset more usable, and more relevant to the potential adopters, than was that available to the RUS's. In short, much of the difference in the two experiences may be attributable to the different nature of the "product" in the two cases, as well as to the differences in the administrative arrangements employed.

In general, the OE pilot program, while quite limited in scope, was apparently more successful than that of the SRS. In large measure, this difference may be attributed to the fact that the educational system is more closely analogous to the agricultural system than are the state VR agencies. In addition, the OE program was able to adopt a set of administrative arrangements which avoided many of the sources of "organizational static" which appeared in the SRS approach (it should be added that the decentralized model used by OE could not have been used by SRS, because of the different nature of the two programs). In neither case is the evidence clear and unambiguous that the agricultural extension model is the sole or best answer to the problem of research utilization; a major part of the utilization problem remains the lack of connection between need-identification and the instigation of research and inquiry, and no extension model has satisfactorily cured this ill, found in many federal programs. However, at least in the case of educational research where the parallels with the agricultural situation are not stretched too thinly, the use of the agricultural extension model can provide an alleviation for some of the more serious difficulties in research utilization. Neither the U.S. Office of Education nor the Social and Rehabilitation Service quite grasped the total scope of the agricultural extension model: They only implemented a system to diffuse *existing* innovations (based on prior research) to users, but failed to establish a research utilization *system* that also included means by which users' needs could be translated into research problems. To make a metaphor, *OE and SRS established an extension service, but not the other components of the land-grant college/agricultural experiment station/extension service complex*. Perhaps the SRS and OE attempts at extending the agricultural extension model would have been relatively more successful if they had implemented the entire research utilization complex, instead of just the innovation-diffusion component, but such a broader scope would have involved much greater costs and necessitated major restructuring of the two organizations, without any guarantees of additional success.

If the U.S. Office of Education experience with educational extension agents was relatively more successful than the Social and Rehabilitation Service's RUS program, why might this be so? We conclude that three considerations would be most important in affecting the relative success of these two attempts to extend the agricultural extension model:

1. A greater degree of users' needs-orientation was displayed by the educational extension agents than by the RUS's. The educational agent started with his client's problem, the RUS with his accumulated research knowledge.

2. The education agents' clients were mainly individual teachers and administrators, while the RUS's clients were subsystems within the state SRS agency. Thus the client-as-individual assumption of the agricultural extension model was more easily transferred to the U.S. Office of Education activity, where the extension agents introduced innovations to teachers, rather than trying to change schools.

3. The educational extension agent had more realistic client ratios than his SRS counterpart. He typically operated in several local school districts, while the RUS was officially assigned to serve all of the SRS personnel in an entire state, ranging up to 1,300 in one state.

National Diffusion Network Program

A different approach to the diffusion of education innovations was begun by the U.S. Office of Education, with some minimum assistance from the National Institute of Education (NIE) in 1974.* It is called the "National Diffusion Network Program", and represents several important changes and modifications from (1) the agricultural extension model, and (2) the educational extension agent pilot project of the early 1970's, which directly influenced the diffusion strategies followed by the National Diffusion Network Program. The most important of these strategies are:

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*NIE was created in 1972 with a goal of reforming educational practice in the U.S. (Clark and Guba, 1974). At the same time, however, OE also continued with its dissemination activities.

1. The source of educational innovations are developer/demonstrators (D/D's), local schools or school teachers that invent and develop a new idea, perhaps with some assistance from technical experts like college professors, R & D laboratories, or commercial suppliers. In order to become a D/D, a description of the innovation developed is submitted, along with evaluative evidence of the innovation's relative advantage, to an expert committee in Washington called the Joint Dissemination Review Panel (JDRP), composed of OE and NIE staff. Once approved by this committee, the innovation is considered a "validated practice." In July, 1974, when the National Diffusion Network Program was launched, 31 D/D's were approved and funded; six more were added in 1974-75; and 36 more in 1975, making a total of 73 validated and OE-funded innovations. In addition, 50 or so other innovations (and D/D's) were approved, but not funded by OE.

Obviously, the emphasis on local schools as inventors/developers in the National Diffusion Network Program reflected a shift in OE thinking away from expert R & D sources of educational innovations,* and recognized the greater credibility attached to a D/D's innovation by other school personnel in the target audience.

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*Although in mid-1975, the Far West Laboratory for Educational Research and Development was connected to the National Diffusion Network Program in order to offer technical assistance.

Also, the relatively large number of innovations included in the Program (73 funded; about 120 that were validated), and their wide variety, implied an abandonment of the previous assumption in the field of education that certain "standard" innovations (like team teaching, programmed instruction, teacher aides, videotape cassettes, etc.) could each be promoted to all public schools. Most of the 73 innovations, in fact, are appropriately applicable only to certain schools that have certain common problems.

The main focus on the bottom-up development of innovations in the NDN approach is made workable by the role of the Joint Dissemination Review Panel, which screens out inappropriate educational innovations from the diffusion network. Thus technical expertise is still brought to bear at a point where it can be most useful (in innovation screening), even though such R & D expertise plays only a minor role in creating the educational innovations (by the D/D's). In fact, the 120 validated practices were selected out of about 300 submitted.

The chairman of the JDRP, a Deputy Commissioner of OE, stated: "In the past it was enough to say a program was effective if someone visited it and came back saying, 'The parents love it; the kids love it; and I saw it and it looked good'" (Neill, 1976). This official feels that school personnel are now demanding "hard" evidence that an innovation can be advantageous if replicated in another site, that changes in cognitive scores or in attitudes claimed for the innovation is not due to the Hawthorne Effect, or to a particular setting and a particular teacher. Further, JDRP requires that each potential D/D provide cost data so that a future adopter can know approximately what resources will be necessary for materials, training, and additional staff if the innovation is adopted.

2. When a D/D's innovation is validated, the D/D may be provided with federal funds by USOE to provide training about the innovation to potential adopters, to produce brochures and other mass media messages about the innovation, and, generally, to become a demonstrator for the innovation (hence the title "developer/demonstrator"). Potential adopters can visit the D/D to observe the innovation in use and to discuss it with D/D staff, who, as might be expected, often display a missionary enthusiasm for their innovation. The D/D staff may even demonstrate the innovation at the potential adopter's site, or at a third site.

3. As Figure 3 shows, "facilitators" are provided to link the D/D with "adopters." The facilitators are the equivalent of the county extension agent in the agricultural extension model, and of the educational extension agent in USOE's education dissemination pilot project of the early 1970's. The facilitators are federally funded through USOE grants to about 77 projects, each with a staff of from one to ten facilitators who are responsible for linking the 73 D/D's with potential adopters in all or part of a state.* These facilitator projects were mostly

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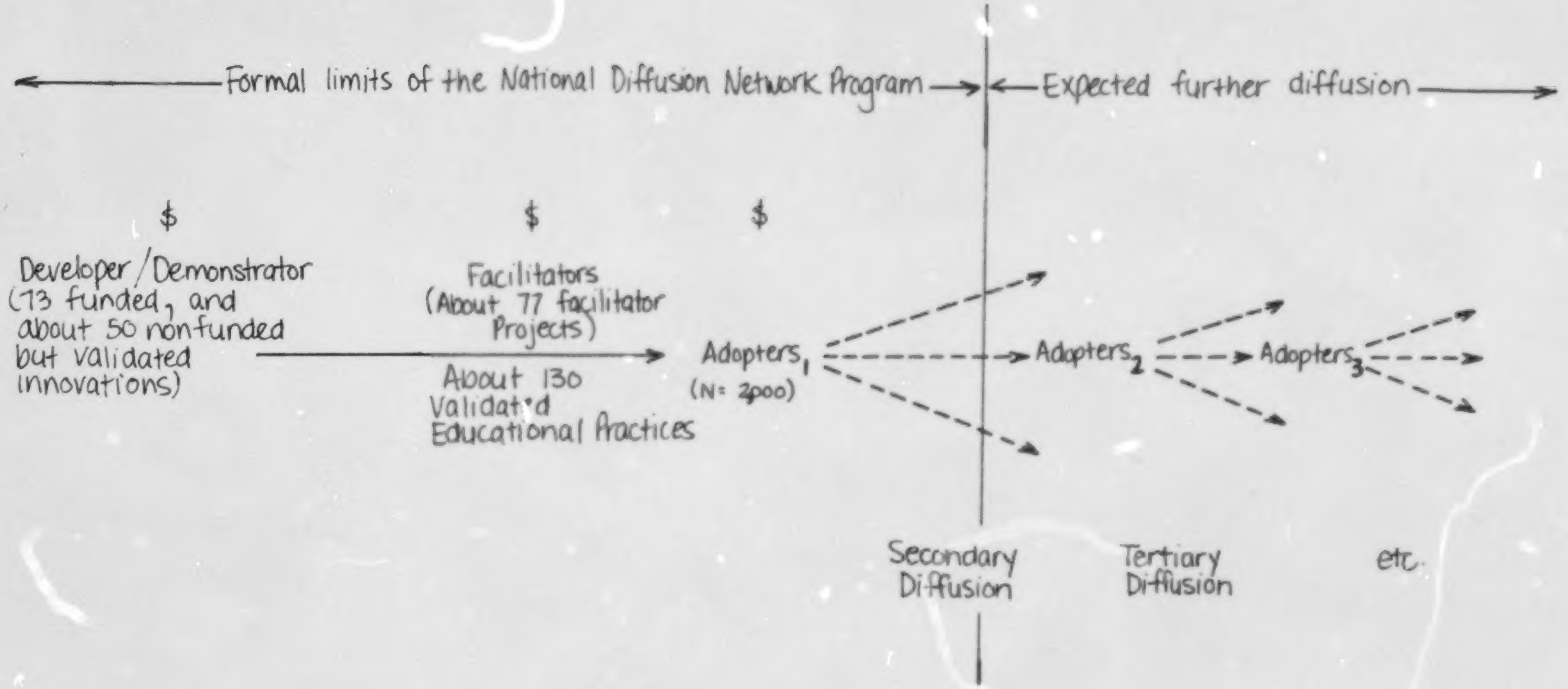
*The 77 facilitator projects were located in 36 states by the end of 1975; in the remaining 14 states, SEA's were provided some federal funds under a separate ESEA authorization to carry out certain of the facilitator activities.


Formal limits of the National Diffusion Network Program
Expected further diffusion
$
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Developer/Demonstrator (73 funded, and about 50 nonfunded but validated innovations)
Facilitators (About 77 facilitator Projects)
About 130 Validated Educational Practices
Adopters$_1$ (N= 2000)
Adopters$_2$
Adopters$_3$
Secondary Diffusion
Tertiary Diffusion
etc.

Figure 3. Paradigm of the OE's National Diffusion Network.

funded for the one-year period to June, 1975 (with perhaps the possibility of refunding on the basis of their demonstrated effectiveness). The responsibilities of the facilitators include (1) assisting the D/D's in their area, (2) identifying adopters that represent a range of local school conditions (such as rural, suburban, and urban communities), for which one of the 73 validated practices are applicable, and (3) assisting such adopters in their area in becoming aware of the innovation, visiting the D/D, receiving training about the innovation, adopting it, and diffusing it to other adopters. The facilitator has a rather hopeless client ratio (for example, the facilitator project in the state of Michigan serves about 117,000 public school teaching personnel), but this ratio becomes more realistic because (1) the facilitator only works with the 73 funded innovations, and the 50 non-funded but validated innovations, (2) among a modest number of identified adopters, and (3) the facilitator is assisted by the D/D's staffs in diffusion activities.

4. Some adopters (Figure 3) sign an "adoption agreement" with their facilitator (about two-thirds do not), indicating their intention to adopt the validated practice. Occasionally the adopter is provided with funds from OE through their facilitator to offset travel costs for the adopter to travel to the D/D to observe the innovation, to purchase release time in order to receive training about the innovation, and/or to purchase materials required to adopt and implement the innovation.* As of

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*Actually, the direct funding of the Adopters, was discontinued in 1975, and some facilitators then provided limited financial assistance.

September 1, 1975, there were an estimated 1,000 formal adoption "agreements," and upwards of 2,000 "adopters."* Obviously, as Figure 3 indicates, a secondary diffusion from the Adopters_1 schools is expected, a tertiary diffusion from the Adopters_2, etc. The exact extent of such secondary and tertiary diffusion has not yet been determined, and it is still rather early for such further diffusion to have occurred at the present writing. "Adopter incentives" are provided only to the Adopters_1, thus ensuring that most schools do not adopt the innovations unless they are perceived as appropriate to their own felt needs (Clark and Guba, 1974).

5. A considerable degree of re-invention and modification of the D/D's innovations is encouraged on the part of the Adopters_1 as they fit the innovation to their actual school conditions. In some cases, it has been noted that the Adopter_1 may re-label the D/D's innovation, even when its form has not been modified to any considerable degree, suggesting that the Adopter_1 may be motivated to give the appearance of modification for psychological, egoistic, or socio-political reasons.

6. The National Diffusion Network Program, as shown previously, emphasizes training of the adopters about the innovation and providing in-person, on-site assistance as important mechanisms of diffusion. To this extent, there is a parallel to the early agricultural extension work by county agents.

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*An "adopter" is defined as a local school that has learned about an innovation (by seeing a demonstration, undergoing training, etc.), implemented it in the school system, and expressed an intention to continue using the innovation for a reasonable period.

7. The Program also is nationwide in scope (as is indicated by its name, the National Diffusion Network Program), rather than only being a pilot project of seven educational extension agents in three states, like its predecessor of the 1970's. And the funding of the NDN is considerable, about $16 million during its first two years of operation. Significantly, in states with facilitators, state educational agencies (SEA's) play a relatively minor role in the National Diffusion Network Program. Some of these SEA's may, by means of a 1975-initiated NIE program of "state capacity-building" grants, become broadly involved in other dissemination activities.

8. The Program, as its name also indicates (the National Diffusion Network Program), emphasizes formation of a communication network among peers that links the D/D's and Adopters$_1$ with assistance from the facilitators. Such a network approach implies that the facilitator is at least partly freed from a major responsibility for expertise about the 73 innovations; the facilitator is thus mainly in charge of building the network of peers, and allowing it to diffuse the educational innovations.

At present, it is too early to draw any conclusions about the relative success of the National Diffusion Network Program. An OE contract was awarded in mid-1975 to the Stanford Research Institute for evaluation of the Program, but the earliest results will not be available until late in 1976.

In any event, the National Diffusion Network Program represents an ingenious attempt by the OE to modify the agricultural extension model to the particular organizational conditions of

U.S. education. The degree of modification of this model is much greater than in the educational extension agent program that preceeded the National Diffusion Network Program.

AGRICULTURAL EXTENSION IN DEVELOPING NATIONS

As we have noted, the apparent enormous success of the U.S. agricultural extension model stimulated interest in the possibility of applying this system to other problems of research utilization in other social contexts. If we could attribute a large part of the fantastic increase in the productivity of North American agriculture to new technology and the extension services which diffused it to farmers, so the argument ran, why could we not do the same in the developing countries of Latin America, Africa, and Asia, where the pressures for food were increasing rapidly in the post-World War II era? After all, food-growing is food-growing, and the diffusion approach that had worked so well in the U.S. should perform similar miracles in other cultural contexts. Or so it seemed in 1950.

During the 1950's and 1960's, the agricultural extension model was "exported" almost intact to many less developed countries. This transfer was primarily sponsored by the U.S. Agency for International Development (AID), in cooperation with the North American land-grant universities and their associated state extension services. The Kellogg Foundation, and to a lesser extent the Ford and Rockefeller Foundations, were also involved. Efforts to transfer the agricultural extension model usually centered in ministries of agriculture in most nations, and consisted of constructing a network of local extension agents and subject-matter specialists under the ministry, or, at times, attached to agricultural universities. A major difference apparent at the start of such efforts was that the source of most of the technical knowledge to be diffused to local farmers was imported, largely from the U.S., rather than derived from local experimentation. And much of this North American research had been conducted in temperate climates, with a dubious applicability to the tropical and semi-tropical conditions most frequently found in developing nations.

Nevertheless, the system parallels were extremely striking, at least in the nature of the organizational arrangements adopted to carry out the extension effort. Large numbers of U.S. county extension agents and state-level specialists were hired by AID in the 1950's, and posted in Quito, Lagos, Rio, etc. where they served as consultants to ministries of agriculture. In many cases, AID contracted directly with a state land-grant university system to establish a counterpart agricultural college and extension service in a developing nation. Thus Michigan State University staff were in Colombia, Purdue University and the University of Wisconsin in Brazil, Colorado State University in Nigeria, Cornell University in the Philippines, the University of Kentucky in Indonesia, North Carolina State University in Peru, etc. In some larger countries, several U.S. land-grant institutions were assigned by AID to assist one or more contiguous states; this led to a half-joking reference to these areas of the host country by the name of the U.S. university. Thus India in the early 1960's was "divided" into "Ohio State," "Illinois," "Kansas State," etc. A certain degree of false possessiveness was even involved in such technical assistance arrangements; Ohio State University extension personnel took pride in the Punjab State's more rapid agricultural progress than Andra Pradesh's, where Kansas State University was assisting an agricultural university/extension service set-up.

Generally, the U.S. personnel sought to establish as exact a replica as possible of the North American agricultural extension model, complete with local extension agents and central extension training centers to produce them, extension specialists, and agricultural colleges. Promising individuals in the host country were selected for graduate training in agriculture at Columbus, East Lansing, Ft. Collins, etc. AID and the foundations paid the bill for the North American advisors, and for the extension services they were creating in Latin America, Africa, and Asia.

The slavish copying of the U.S.-based agricultural extension model occured throughout developing countries, with few exceptions. However, one such deviation happened in Taiwan, where Lionberger and Chang (1970) found that the agricultural extension agents were perceived as highly credible because they operated farms and would not recommend an innovation to their clients until they had previously adopted it on their own farms.* In the U.S., extension agents were forbidden to operate a farm because of concern over a possible conflict-of-interest. The Taiwan experience, in fact, suggests that the U.S. extension services may have been missing an important basis for the safety credibility of their change agents. Further, the different socio-cultural conditions of Taiwan (and other developing countries) suggests that the agricultural extension model should have been adapted, not adopted.

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*These agriculture extension agents in Taiwan possessed only an elementary or high school education, and so they could not depend on competence credibility, as could their university-educated counterparts in the U.S. and other countries (Lionberger, 1974).

A number of differences in the extension situation of developing countries became apparent fairly rapidly. One of the most important difficulties facing the extension systems in developing countries was the sheer immensity of the job to be done. In 1960, the U.S. had between three and four million farmers. India, by contrast, had at least 100 million farmers living on the land. The resources available for the extension service effort in India were, however, much more limited than in the U.S.* The result of such huge differences in resources and task is that in developing countries local extension workers were faced with hopelessly large client ratios. In less developed countries in general, there are about 10,000 farmers for each local extension agent. In the developed countries, the ratio averages about 1:400 or 1:500, a client:farmer level recommended by the FAO as ideal (Rice, 1974, p. 121). How can one extension worker hope to contact, let alone work intensively with, 10,000 clients? The answer is that he cannot. And further, extension services in developing nations have been too poor to employ extension specialists (Rice, 1974, p. 120). The response to this impossible challenge led directly to another major problem.

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*For example, the principal constituency of the extension services in Latin America are smaller and medium-sized farmers, who are unorganized and without political muscle. As a result, extension services are seriously underfinanced; for example, the ministry of education in Costa Rica receives 23 percent of the central government budget while the ministry of agriculture receives only 2 percent, and only a small share of this goes to agricultural extension (Rice, 1974, p. 95).

The improvement of agricultural production by means of new technology in the developing countries exacerbated the inequalities between the rich and poor farmers, and concentrated agricultural wealth, power, and knowledge in fewer and fewer hands. We previously noted the same general trend in the U.S.; however, in developing countries the gaps are wider both relatively and absolutely, and the lack of adequate industrial opportunities to absorb all the families whose marginal farms could not support them caused this unequal concentration of income to be a greater social problem. Further, the importation of U.S.-produced agricultural innovations contributed to widening the socio-economic gaps between commercial farmers and peasants in less developed nations. For example, tractors and related farm equipment are used today in the U.S. by small farmers with 160 acre operations, as well as by more elite farmers with 900 acres or more. The large farmer in a developing country with, say, 200 acres can profitably adopt a tractor. But what use is such equipment to a peasant with 2.5 acres, fragmented into 70 tiny plots that are not located contiguously? A tractor cannot even turn around in such space. Similarly, such "made in the U.S." innovations as chemical fertilizers, hybrid corn, and insecticides/pesticides were eagerly adopted by large farmers in developing nations, but were beyond the means, and often simply unavailable, to subsistence farmers.

A recent example of the problem of growing gaps is the so-called "Green Revolution" in India, Pakistan, and numerous other countries. The "Green Revolution" refers to the sudden, dramatic increase in grain yields brought about by the adoption of improved crop varieties, chemical fertilizers, pesticides, and mechanization (Rogers, 1972, pp. 78-82).

When the new "miracle" wheat seeds from Mexico were introduced in India, Pakistan, and other nations, the limited supplies were first channeled to large, progressive farmers. Hence, the spectacular consequences of the Green Revolution were mostly reaped by already-rich agricultural elites. "The explosive widening of regional income disparities is one of the most intractable consequences of the Green Revolution. It is the poorer class in the backward regions who suffer the greatest inequity in economic development" (Lele and Mellor, 1972). The social structure determined the innovation's consequences in yet another way. The landowners wanted the full benefits from increased yields, so they squeezed tenants to become share-croppers and pressured them to become landless workers. "Farm mechanization is as irreversible as the Green Revolution which fathered it" (Ladejinsky, 1970); the net result in India was an estimated 35 to 40 million landless laborers who must migrate in search of already-scarce non-farm employment.

The Green Revolution's unequal consequences created widespread frustration among peasants in India, leading to violence in some areas. "According to the [Indian] Ministry of Foreign Affairs, in the first nine months of [1969], 346 incidents of forcible occupation of land (totalling 100,000 to 300,000 acres) with many murdered and injured have taken place in West Bengal alone" (Ladejinsky, 1970). The government of India was deeply disturbed by the land seizure movement and was motivated to deal directly with one of its main causes, the unequal consequences of the Green Revolution. In fact, a Small Farmers Development Agency was created in 1970 to aid peasants with credit and technical advice. So a new development agency was founded, to deal only with small farmers. One might expect it to reach especially the richer of these poor farmers, and there is some evidence that this indeed has occurred in India.

Two factors were directly associated with the problem of widening socio-economic gaps, and both can be traced immediately to the lopsided extension caseloads. With such heavy client loads the extension agents concentrated their attention most heavily on the farmers who sought their help, rather than investing their scarce time in making initial contacts with potential clients. Farmers who actively seek technical innovations are richer, more educated, and hence already more knowledgeable, and less time is required to convince them of the desirability of adopting an innovation.

A second factor in developing nations was that the local agents on the front line--those who dealt directly with farmers, rather than agricultural specialists or higher-level officials--tended to be sub-professionals, with one or two years of technical agricultural training after secondary school, rather than university-trained agriculturalists. Such sub-professionals generally lacked complete understanding of the innovations (developed for the most part for large-scale agricultural enterprises) and were unable to adapt them successfully to smallholder operations. As a result, the extension agents tended to work most closely with the clients who could adopt their innovations with least difficulty--the large, elite farmers--rather than with the marginal farmers (whom the extension system was originally developed to aid in most cases).

Another major problem was the degree to which the social structure impeded individual adoption-decisions. One of the major assumptions of the U.S. agricultural extension model, carried over into the extension systems of developing countries, was that a decision to adopt an innovation is primarily an individual action. Extension agents overseas, parallelling the U.S. experience, presented information about innovations to individual farmers. Unfortunately, in most instances the social structure of village life intervened to prevent such individual decisions. In Latin America, for example, large plantation owners eagerly adopted innovations through individual choice, but smaller farmers often lacked the resources necessary to adopt technological innovations, or were unable to obtain such essential input materials as seeds, fertilizers, or chemicals--or the credit necessary to purchase them. This lack of coherence with the expectations of the U.S.-derived agricultural extension model occurred in African and Asian nations as well--with only rare exceptions.

A number of organizational problems also compounded the difficulties of applying the extension model in developing countries. In many cases, the extension responsibility was housed in the government ministry of agriculture, while the rural development funds--the wherewithall which farmers might invest in innovations--was the responsibility of the finance or economics ministries, or of a separate agricultural credit agency. For instance, most developing countries have in addition to an agricultural extension service and an agricultural credit agency, an agrarian reform agency, a rural colonization service, a cooperative development service, a community development agency, and many other government bureaus that engage in agricultural development activities, all in an uncoordinated fashion. Often the agencies actively compete for funding and clients' attention.*

Another difficulty facing the new extension services in developing nations was the lack of client credibility in governmental activity in cultures which associated government more with punition than with assistance. Where ministries of agriculture are simultaneously involved with the provision of technological information, and with the regulation of farming activity, the extension function is likely to be viewed with suspicion at best. This ambiguity of the government role was compounded in countries whose post-colonial regimes inherited previous concerns with law-and order. For instance, in one developing country, local extension workers are also responsible for tax collection from farmers. This incompatible function makes it difficult for them to also act as friendly advisors to farmers.

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*This problem helped give rise to "integrated rural development programs", which were launched in about 70 countries in Latin America, Africa, and Asia in the 1970's. Such integrated approaches are still dominated by agriculture, but often include some aspects of health and education (Rogers and Meyer, 1976).

While governments in developing countries have generally favored the modernization of their citizens' attitudes and behavior, and frequently mounted major mass media campaigns to promote such modernization, the effect has often been to raise the level of expectations, without being able to meet these expectations. Extension work sometimes has contributed to this problem, by assuming that its efforts should center more on promoting "modern" attitudes than on facilitating the adoption of specific innovations. This error was a logical, if not correct, response to the overwhelming task set for the extension agents. The effect was often creation of a rising era of farmer dissatisfaction, where no effective means of meeting the higher expectations could be realistically developed.

Still another difficulty in many developing countries was the socio-economic distance between local extension agents and the farmers they tried to assist. In most of the less developed countries, a farmer is fortunate to possess two to three years of schooling and a level of functional literacy. Even a subprofessional extension aide with a secondary education may seem to be from another world. University graduates in agriculture almost never came from farming backgrounds--at best, they might be the sons of rich landowners. Often they were urban elites. Their background and style of life was vastly different from that of the peasants with whom they tried to work. This social distance set up many problems of interpersonal communication which impeded the ability of the extension workers to reach the majority of their clients.

We have identified in this section a number of shortcomings in the transfer of the U.S. agricultural extension model to developing countries. While the extension services led to some significant rises in agricultural output, they also led to an increase in the relative position of the well-to-do landowners at the expense of peasants and thus exacerbated socio-economic tensions. We have noted several reasons for this outcome: A lack of effective communication between local extension workers and potential clients, partly caused by excessive client loads and partly by gaps in social distance, inability of governments to supply technology and development resources in a coordinated fashion, and the difficulties in adapting agricultural technology to developing countries' needs in a specific and useful way.

None of these problems constituted a rejection of the agricultural extension model per se, or suggest that it could not be applicable outside the North American continent. But attempts in recent years to export this model largely failed to adapt the operations and expectations of the model sufficiently to local social-structural and cultural conditions. A model which functions in a situation where people displaced from farms have somewhere to go, where there are no major socio-cultural gaps between the extension agents and their clients, where it is possible for the average farmer to implement more or less by himself many of the innovations which he learns from the extension agent, and where he generally trusts the government system to provide him with useful assistance rather than to police him--such a model cannot be directly transferred to socio-cultural situations where these background conditions do not operate. While the basic idea of the agricultural extension model might be sound, a lack of sensitivity to inconsistencies between the U.S. and third-world contexts made the application of the model in less developed countries far less effective and satisfactory than it might have been.

The rise-and-fall of the agricultural extension model has been most thoroughly analyzed in the case of Latin America by Rice (1974). Here, agricultural extension services were created with U.S. assistance in almost every country: "Extension was the centerpiece of U.S. rural development strategies in the 1950's in Latin America" (Rice, 1974, p. 23). By 1958, the extension services were on the wane throughout Latin America, and AID started to phase out its technical and financial assistance to national extension services in 1960. Latin American governments were not convinced to adequately fund such extension programs, in part because they had not led to much increase in agricultural productivity (Rice, 1974, p. 64). In most Latin American nations today (Colombia and Argentina may be exceptions), the agricultural extension model has been abandoned as the main strategy for rural development. Instead, most nations are now embarking on an alternative approach through integrated rural development programs, in which the agricultural extension service, along with agricultural credit, health, nutrition, family planning, and other development agencies, are coordinated locally in village self-development (Rogers and Meyer, 1976). Similar enthusiasm for this new approach is found in African and Asian nations. It is too early to conclude that integrated rural development will be any more successful than the agricultural extension model that it replaced. But importantly, the idea of integrated rural development did not originate in the United States*, nor are the U.S. government and foundations especially active in promoting it. So appropriate adaptation in each country is more likely.

We conclude that the agricultural extension model has not been highly successful when transferred to agricultural applications in less developed countries. A basic reason, we feel, was a too-close copying of the agricultural extension model in socio-cultural contexts where considerable adaptation was necessary. After reviewing agricultural extension services in the U.S. and in several developing nations, Axinn and Thorat (1972, p. 184) conclude: "The striking characteristic appears to be the similarities among agricultural extension education systems rather than the differences between them. That is, even in rural social systems that differ greatly in terms of the kind of technologies employed, the levels of living, the degree of specialization in various organizational configurations, and the nature of the agriculture being practiced, there are great similarities in the organizations that carry out agricultural extension education."

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*The main models for integrated rural development are Comilla in Bangladesh and Puebla in Mexico.

Too bad.

AGRICULTURAL EXTENSION APPLICATIONS TO FAMILY PLANNING PROGRAMS*

The attempt to apply the agricultural extension model to the diffusion of family planning innovations began in the middle 1960's, primarily in those developing countries plagued with drastically increasing population growth rates: India, Pakistan, Korea, Taiwan. The extension model was followed in response to the perceived failure of the previous "clinic" approach to provide contraceptive services to the target audience of married couples of reproductive age. Introduction of the extension model resulted in a short-lived rapid success, followed by a tapering-off in the rate of adoption of family planning ideas. The case provides an interesting illustration of the adaptation of the agricultural extension model to the requirements of a new area of activity--and of the limits of the model even with such adaptations.

Until the 1960's, family planning services in the developing countries were provided almost without exception through medical clinics patterned explicitly on Planned Parenthood operations in the West. The most common birth control technique was the diaphragm, which required medical expertise at the time of adoption. In general, family planning was seen as an extension of on-going programs in maternal and child health (MCH), and the effort was administratively centered in government MCH clinics, on the theory that mothers could bring children to the clinics and receive family planning services at the same time without incurring public hostility or censure.

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*The present section is an adaptation of the central ideas in Rogers (1973a).

The response to this clinic approach was in most cases disappointing. Relatively low levels of client adoption were achieved, particularly considering the relatively high costs involved in the construction and maintenance of clinics. Most developing countries, with a general shortage of public health funds, could afford only a limited coverage of the country with full-scale clinics, and thus substantial numbers of potential clients, particularly in villages where the need for services was greatest, were unreached. Moreover, provision of family planning through the clinic channel appeared relevant only to those individuals for whom maternal health was a primary motivating force for the adoption of family planning. It did not tap, for example, the economic incentive to parents for limiting their family's size.

In the middle 1960's, the passivity of the "clinic era" gave way to the activism of the "field era". In country after country, an explicit diffusion approach founded philosophically, if not operationally, on the agricultural extension model, began to be implemented. The field approach involved activities mainly outside the clinic. While clinics were still maintained for a variety of medical purposes, a system of family planning "field workers" or "motivators", patterned after local agricultural extension workers, were established to spread knowledge of family planning innovations, to discuss their adoption with potential clients, and to direct the clients to clinic services. This viewpoint considered the value of the innovations being promoted as self-evident, and held that the major barrier was the lack of knowledge on the part of potential adopters--a barrier which could be overcome with enough local change-agentry.

Originally, the field worker was expected to be a sort of "miniature clinic", projected into the client's home, not only spreading information but often dispensing family planning supplies as well. The development of such contraceptive technologies as the pill and the IUD, together with a new view of the role of such male-centered methods as the condom and vasectomy, made this medical-extension approach feasible. However, inadequate numbers of trained personnel were swiftly encountered in most areas. As with his counterpart in the agricultural extension model, it was assumed at first that the field worker should be technically competent, preferrably a university graduate. Even with simplified contraceptive technologies, a certain level of professional training was needed, but pressures to expand the national family planning programs beyond the limits of rapid training forced a reevaluation of these expectations.

The response in most cases was to shift to a system of paraprofessional aides to supplement the trained medical personnel of the clinics. These aides were usually individuals from the local community, perhaps themselves early adopters of family planning who could presumably communicate with other villagers more effectively than could city-trained physicians or nurses. In India, for example, considerable use was made of male canvassers who themselves had had vasectomies--presumably to illustrate that the operation was neither fatal nor debilitating.

The use of aides was usually supplemented by a series of other methods of "bringing family planning out of the clinics to the people". On the theory that the convenience of services might be a barrier to their utilization, a number of countries, particularly India, invested in mobile clinics, setting them up in places where people already congregated such as railway stations or temporarily in remote villages. Extensive mass media campaigns for family planning were also conducted, although their effectiveness may have been less than was originally anticipated. In addition, several national family planning programs began paying cash incentives for adoption of certain methods, particularly sterilization.

By the early 1970's, some second thoughts about the effectiveness of the field era began to emerge. Programs began to taper off in the rate of adoption, despite the fact that surveys showed very high levels of knowledge (often 70 per cent or more) about family planning among the target population. While the field-oriented programs were generally not abandoned, there was a shift of interest from this approach to various anti-natalistic government policies, such as the liberation of women, postponement of marriage, tax incentives for smaller families, and the like. Thus, while diffusion and extension techniques remain important in family planning programs, they are today usually seen as only one part of a more complete social development program providing beyond-family-planning motivation for smaller families, rather than as a self-sufficient solution to the problem of overpopulation.

A number of crucial differences exist between the bases of the agricultural extension model and the situation confronting national family planning programs, which called for modifications in the agricultural approach. One problem, which we noted previously in other attempts to apply the agricultural extension model, is that the adoption of family planning innovations was seldom an individual decision. At the least a couple is involved, and not infrequently, particularly in developing countries, wider community sanction must occur. Thus an element of system involvement had to be introduced in the family planning extension efforts which was not so necessary in the U.S. agricultural context.*

A further and related problem is the taboo nature of family planning discussion--an element certainly not present in the agricultural context. In order to deal with this problem of taboo communication, family planning programs necessarily become closely involved with the socio-linguistic aspects of the words and terminology they used--even, in some situations, being forced to invent new words to circumvent the negative connotations attached to terms such as "condom". To a large degree, the use of local aides represented an attempt to overcome some of these communication gaps, as well as to stretch the available professional personnel further, and at a more affordable cost.

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*In the People's Republic of China, where the U.S.-originated agricultural extension model was unknown, or at least not followed by the family planning program, collective decision-making about the number of children born and the adoption of contraceptives is facilitated by the "group planning of births" (Chen with Miller, 1975).

Another major difference from the agricultural model is that family planning programs sought not so much to secure adoption of specific innovations, as to secure acceptance of a general approach (family planning), which might entail the adoption of any of a number of specific contraceptive techniques.* Seldom could unambiguous benefits be attached to any particular method. Each innovation has its advantages and drawbacks, and may be appropriate only to particular couples and certain conditions. In the context of agricultural extension in the developing countries, we spoke of the distinction between creating a general climate of modernization, and the promotion of specific agricultural innovations. Somewhat the same distinction may be observed in the family planning case; the difference, however, is that here the emphasis is more effectively placed on the acceptance of the principle or the concept, than on the acceptance of the hardware itself.

Family planning extension programs also encountered the same problem noted as crucial in the agriculture effort in developing countries: The gap in social distance between the change agents and their potential clients. The more technically competent the change agent, the larger this gap. In the agriculture case, we noted that the minimum level of technical competence thought to be appropriate, seemed to be too great to overcome the interpersonal communication problem easily. In the family planning case, the use of aides proved more practical in diffusing innovations. This great reliance on aides frequently necessitated that clients pass sequentially through two levels--aide and clinic--to secure contraceptive services.

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*This is the so-called "cafeteria approach" in which a client is encouraged to adopt any one of a number of different family planning methods.

The history of the application of the agricultural extension model to national family planning programs, especially in Asia, consists of a series of trade-offs between the expectations of the model, the requirements of the situation, and the relative costs and benefits of reconciling the two. The use of peer-aides helped overcome the problems of taboo communication, but at a cost in the efficiency of services. The payment of cash incentives helped increase the adoption rate, but at a cost in the "quality" of the adoption-decision and consequent backsliding and discontinuance of family planning. The use of mass media campaigns increased the number of potential clients with a basic level of information, but at a cost of diminishing returns.

The adaptation of the agricultural extension model to the family planning context has probably been more successful than its application either (1) to the case of agricultural development in developing countries, or (2) to the research utilization problems of certain federal agencies in the U.S. It succeeded not because it is inherently any more applicable, or because its assumptions are more completely fulfilled. The main reason appears to lie in the fact that for the most part appropriate adjustments were made in the model, and these modifications (aides, incentives, etc.) were effectively implemented. Even so, in recent years it appears that national family planning programs in developing nations may be reaching a point of declining effectiveness.*

The response of the U.S. extension services at a similar point was to reach for new types of services and new clienteles. It remains to be seen what adjustments will emerge for family planning efforts over the long run, but certainly the beyond-family-planning strategies for lower fertility are receiving major attention today. The general implication is that the agricultural extension model may have paid inadequate attention to providing motivation for adoption of research-based innovations.

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*For instance, only in the five relatively small countries of Taiwan, Korea, Hong Kong, Singapore, and Mauritius, and perhaps in the massive case of China, have national family planning programs been able to achieve a measurable decline in age-specific fertility rates to date, although national programs now underway in many of the 44 other developing countries may not have been in operation long enough to show demonstrable results.

APPLICATIONS OF THE MODEL TO THE DIFFUSION OF TECHNOLOGY AMONG PRIVATE MANUFACTURING FIRMS

The idea of applying the agricultural extension model to the diffusion of knowledge in areas other than agriculture is not new. It is sometimes forgotten that the original Morrill Act of 1862 provided for colleges "of agriculture and the mechanic arts". Knowledge in science and engineering has been a major preoccupation of the land-grant college complex, as we noted in the first section of this paper. Unlike agriculture, however, industrial technology has never become the primary focus of an extension effort by the land-grant colleges for a variety of reasons. Until recent years, little Federal funding was provided directly for research and development in industrial technology; such research remained mainly the preserve of private business itself. Since the Second World War, however, the vastly increasing investment of the Federal government in technology for defense, space, and other purposes has spurred the same sorts of questions about utilization in these sectors which we have noted in education and rehabilitation: The problem is somewhat different, of course, in that the Federally-sponsored technical research has at least a primary application in its initial area, and the "extension" effort sought largely secondary or spinoff utilization. However, there remains a definite sense that Federal technological research, like the research areas in agriculture, education, etc. that we have discussed, does not find as general a market as it should.

In this section we discuss two major attempts to create versions of the extension model to diffuse Federally-sponsored technical research to private businesses: (1) the Commerce Department's Office of State Technical Services (OSTS), and (2) the National Aeronautics and Space Administration's (NASA's) Technology Utilization Program. Neither of these operations can be termed wholly successful; OSTS in fact has been disbanded. We believe that these two case histories suggest that industry-oriented Federal technology-transfer programs face some special difficulties when they attempt to move beyond basic information dissemination. There is no industrial counterpart to the integrated research, development, and technology-transfer system which constitutes the agricultural extension model. The problems faced by agencies trying to implement parts of this system in the industrial area illuminate some additional problems of "extending the model".

Office of State Technical Services

The Office of State Technical Services represented a fairly direct effort to apply the agricultural extension system to problems of industrial development and operation. Originally conceived in 1962, it began as the "Civil Industrial Technology Program" within the U.S. Department of Commerce. The original aim was to stimulate research in lagging industries such as textiles, machine tools, and building. CITP was designed to make grants directly to manufacturing companies for research and development. It was funded only for fiscal year 1963 at about $1.6 million. Considerable opposition developed almost immediately to the allocation of Federal funds for research in the private sector, in competition with private dollars. The program did succeed in establishing an "information center" to pool information in the textile industry, and it developed a variety of information-sharing ideas which later found their way into OSTS practice. But the generally negative reaction of the Congress doomed this first attempt.

Frustrated in their attempt to create a direct Federal program of industrial research and development, U.S. Department of Commerce officials turned their attention to increasing industrial productivity through improved utilization of existing technology. Underlying this approach was an assumption remarkably similar to that of agricultural extension--that there were sectors of the economy which were relatively poor in the advanced technology pioneered in organized research, and which could benefit from exposure to this knowledge. To counter potential criticism, OSTS was conceived as a state-based program, operated primarily out of the land-grant colleges, with state funds matching the Federal dollars and state agencies establishing program priorities.

The idea of OSTS affected many different groups, and most of them became involved in the process of creating and implementing the legislation. The Association of Land-Grant Colleges, the industrial development agencies in the states, a number of Federal agencies (USDA, Economic Development Administration, Small Business Administration, etc.), a variety of business, professional, and engineering organizations--all participated directly in shaping the program (Schon, 1972). A determined effort was made to stay away from any activities resembling basic product development or technological innovation, in order to avoid the industry criticism which had destroyed CITP. OSTS leaned heavily toward teaching, technical assistance, and information dissemination. Many of its original activities were based on existing prototype programs in operation in about 14 states. These programs emphasized consultance, trouble-shooting, and short training courses, and their clients tended to be small firms in relatively non-industrial areas. OSTS had a three-year legislative authorization, but its appropriations were far below authorized levels. About $10 million was spent through OSTS in the 3 1/2 years of its operation.

In early 1970, a series of Congressional hearings investigated the technology-transfer activities of the U.S. Department of Commerce. OSTS had been eliminated in a Departmental reorganization in January, 1970, so the hearings assumed the dimensions of a post-mortem. A major point raised in the hearings was that the limitation of OSTS to information-dissemination functions had severely crippled the extent to which it could really help its clients. The program had never been able to cope adequately with the necessity for adaptive research--the process of adapting a technique or practice to a particular local situation. Frequent comparisons were drawn with the agricultural extension program, particularly with the size of its extension component relative to the total government research budget in agriculture. OSTS certainly never represented more than a "bargain-basement" approach to technology-transfer. It had enough resources for only a few demonstration projects, and was thus bound to disappoint those who believed strongly in this function. Certainly OSTS never succeeded in building the kind of clientele network which sustains the agricultural extension system. It may have been unreasonable to expect this small program to create overnight a system comparable to one which had been building for 50 years--particularly when OSTS's major clients were the smallest and weakest members of the industrial community. As we noted, a major part of agricultural extension's popularity stems from its services to the larger, more influential farmers.

At any rate, OSTS represents another disappointment in the application of the agricultural extension model to non-agricultural areas.*

The NASA Technology Utilization Program

The Technology Utilization Program (TUP) operated by NASA has been a more successful version of the agricultural extension model, if survival is taken as a measure of success.** It is philosophically closer to the U.S. Office of Education approach than to the agricultural extension service *per se*, in that it represents an attempt to utilize research *spinoffs* rather than basic research itself. In the original National Aeronautics and Space Act of 1958, a provision was made for the transfer to the private sector of technology generated by NASA research conducted by its field laboratories and R&D contractors. The core of the transfer program was created in early 1961. It employed six "Regional Dissemination Centers" at major universities in various parts of the country to screen technical developments for possible applications, prepare "technical briefs" and other reports, and assist potential users with problem formulation and information search.* There are "specialty teams" in certain areas of high public interest--biomedical technology and environmental studies--which provide special channels for these applications (Figure 4).

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*In spite of the discontinuation of the federal OSTS program, many states continued to support industrial extension efforts out of their own budgets.

**Or size. TUP in its heyday was the largest research utilization effort of the Federal government, after the Cooperative Extension Service (Doctors, 1971, p. 6).

TUP began as a rather standard governmental service, funded by NASA. However, in 1966 its basis was changed so that thereafter it was to be supported primarily by "subscriptions" (that is, charges for service). Even so, it has not appeared to be wholly self-sustaining. In the first ten years of its operation, it cost NASA about $9.5 million. In its peak year of 1972, TUP served about 3,100 clients, and generated nearly $900,000 in service charges. There has been no systematic assessment of the ecomonic costs or benefits of TUP; some compilations have been made of testimonials from satisfied industrial users. For example, it is reported that the Ford Motor Company saves about $12 million per year with a NASA-developed computer program for stress analysis in structural engineering. With the recent decline in NASA

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*The Regional Dissemination Centers were modeled by NASA after the agricultural extension model (Doctors, 1971, p. 7).

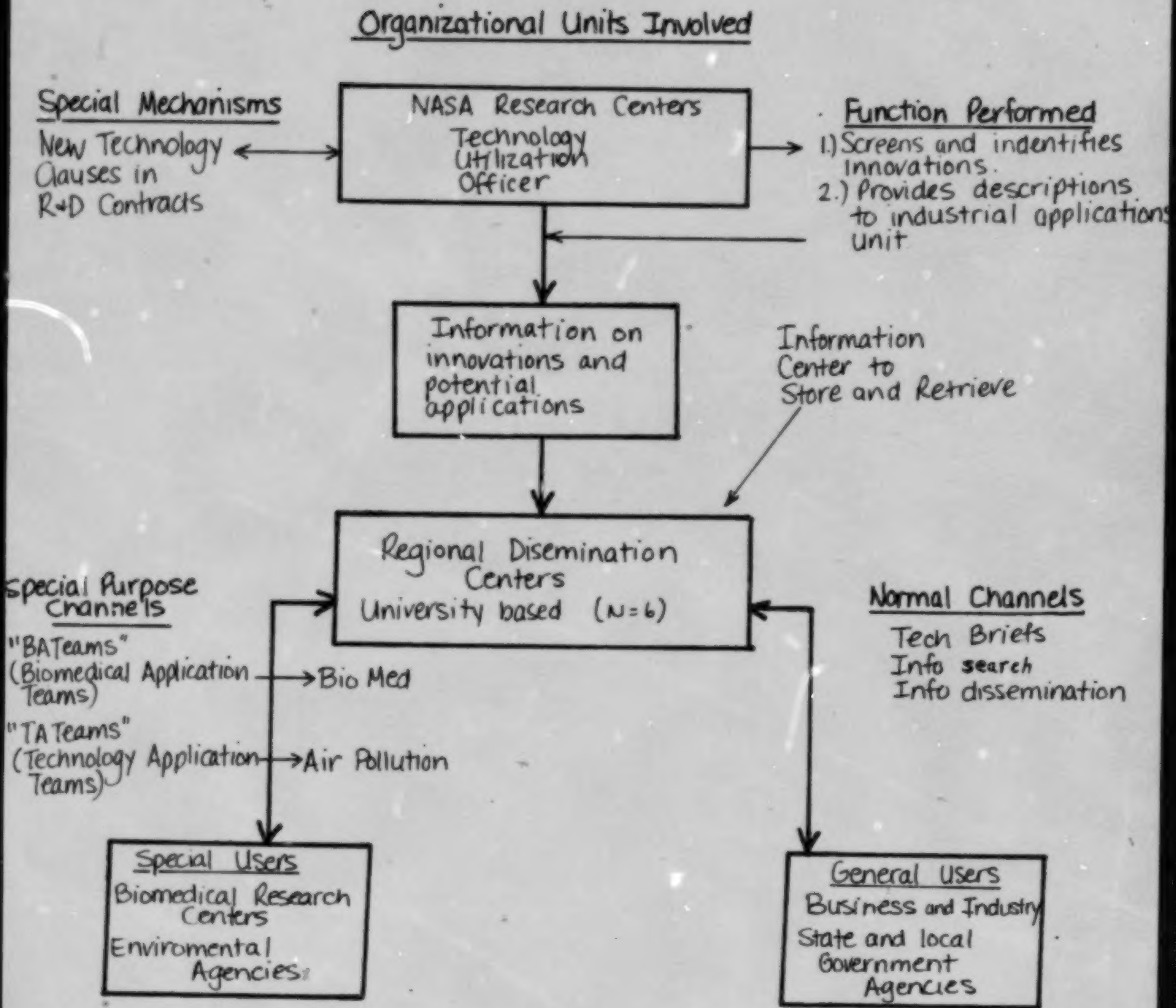
Organizational Units Involved
Special Mechanisms
New Technology Clauses in R+D Contracts
NASA Research Centers
Technology Utilization Officer
Function Performed
1.) Screens and indentifies innovations.
2.) Provides descriptions to industrial applications unit
Information on innovations and potential applications
Information Center to Store and Retrieve
Regional Disemination Centers
University based (N=6)
Special Purpose Channels
"BATeams" (Biomedical Application Teams)
Bio Med
"TA Teams" (Technology Application Teams)
Air Pollution
Normal Channels
Tech Briefs
Info search
Info dissemination
Special Users
Biomedical Research Centers
Enviromental Agencies
General Users
Business and Industry
State and local Government Agencies

Figure 4. Diagram of the NASA Technology Utilization Program.

activities, its technology transfer program has been reduced practically to invisibility.

Like OSTS, TUP has not been directly involved in adaptive research by funding such activities itself. Its greater degree of success (and longer life) can probably be attributed partially to the greater market for its products among influential high-technology clients, and partly to its location in the midst of an ongoing research program rather than on the sidelines "picking up the pieces". Overall, TUP has diffused little technological innovation to its clients (Doctors, 1971, p. 40).

TUP cannot be described as a direct copy of the agricultural extension model, but rather an adaptation of the basic idea to a particular time and research setting. Being more closely linked to its research setting than OSTS, it was able to sustain its emphasis as long as the research program itself lasted (a research thrust that began to lose much of its funding after 1959 when NASA accomplished its main goal of putting man on the moon). By virtue of this particular adaptation, however, it is less likely to form a replicable model for future efforts at technology transfer.

Some General Observations on Extension in Private Business

These two cases--and a number of others not reviewed in detail here, including the experiments being conducted by the National Science Foundation through its R&D incentives program now under way, and the ambitious attempt by Public Technology Inc.* to apply technical solutions to major urban problems--suggest that there are some important elements in the industrial version of technology-transfer which differ from those in agriculture. We have already noted some of the differences in the nature of research itself, and in the value structure applied to it: Agricultural research has almost always been seen as a valid governmental activity, while industrial research is seen as the preserve of the private sector. This element of "competition" between the private and public sectors has characterized the industrial applications of the agricultural extension concept, but has been almost wholly avoided in the agricultural context. Industrial extension has never been able to construct a public philosophy within which all extension activities are seen as valued and necessary. It has thus always been more subject to challenge than agricultural extension.

The task of industrial extension is made inherently more difficult than that of agricultural extension by the greater necessity for adaptation of the technology to specific local settings. Some adaptation must be made with agricultural innovations, but basically seed corn on one farm behaves much like seed corn on other farms (at least within the same climatic area). Industrial technology, by contrast, requires a great deal of adaptation. A key point of leverage in technology transfer is probably the presence of an adaptive-research capability within, or easily accessible to, the firms which are targets of the effort. Firms without access to such capability for adaptive research will probably be the least responsive to an information-based technology transfer operation--even as they may be the ones most in need of the outputs. Industrial adoptors may be more receptive to hardware than to information about hardware, if we wish to accept the lessons learned from the relative success of the TUP and OSTS programs. Moreover, the effectiveness of the transfer process probably decreases as it extends its efforts over a broader spectrum of technology and of potential users. Greater concentration on a smaller range of activities probably makes it easier to deal with specifics rather than generalities, and thus increases the chances for effective communication and research utilization.

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*This PTI approach began in 1974, when 27 "technology agents" were placed in as many U.S. cities to link technology to urban problems. The PTI program is funded by the National Science Foundation at $4.2 million, with matching funding by the 27 cities, for three years.

Thus there is no direct parallel between the agricultural extension model and Federal technology-transfer activities to industry. There are important differences both in the nature of the problem and in the mechanisms which must be adopted to deal with the problems. In general, industry applications of the agricultural extension model have been disappointing. They succeed, as TUP shows us, to the degree that they are rooted in a specific context rather than in a general concept like the extension model. Again, the importance of the context within which the model operates is highlighted for us.

GENERAL CONCLUSIONS ABOUT DIFFUSION FROM THE AGRICULTURAL EXTENSION MODEL

Conclusions

The general patterns of extension system development in the agricultural case and the relative successes and failures evidenced in the other cases described here-in suggest some broad guidelines for public policy and program management. Probably the most impressive insights which emerge from the present analysis are the impressions of the great scope and complexity of the agricultural extension system together with its gradual, organic pattern of development spanning over 100 years of U.S. history. Comparatively speaking, extension efforts in education, social and rehabilitation services, and industry appear woefully under-funded and to have been treated like unwanted children of over-expectant parents. The experiences of developing countries further impress us with our lack of understanding of the reasons for cultural assimilation or rejection of the elements of the agricultural extension model, even in cases where the concepts are being applied to agricultural problems.

Several points stand out. First, the county agent was a product of commercialized agriculture, not subsistence agriculture. He was jointly funded by railroad interests and organized farmers or their elected representatives who were interested in raising successful commercial crops and in moving them to market. Subsistence (pre-commercial) farming environments in developing countries have not embraced the county agent concept, a fact which suggests that the successful introduction of the extension system elements must be carefully timed with respect to the overall economic development of the host country (or organization).

Second, attempts to introduce one or two elements of the agricultural extension model to non-agricultural settings can be viewed as interventionist acts which should not be undertaken without adequate appreciation of the difficulties of social interpretation. Time and resources required to permit these new functions to prove their utility and to become assimilated into the culture of the host system may be easily underestimated. We have seen that agricultural extension evolved and developed its elaborate role structure and functions over a long period of time. Extension specialists emerged because of the increasing complexity and specialization within agricultural research, a situation to which county agents could not respond without diminishing their direct contacts with farmers, and thus reducing their effectiveness. Extension specialists thus emerged to fill this recognizable need, a need which was backed up by powerful supporters of the agricultural extension system who could deliver the votes and the resources to make this adaptation possible. These observations, together with the known failure of modestly-funded efforts to transplant specific elements of the agricultural extension model into other sectors, suggest that an extension system approach, rather than a "county agent" approach, needs to be taken, and that a first consideration in defining the elements required for successful implementation is the identification of a relatively homogeneous client group which can be contacted directly by technically competent and trustworthy agents on a systematic basis. When ratios of clients to extension agents substantially exceed 500 to 1, effectiveness and client acceptance appear to diminish.

Thus, broadly conceived, the agricultural extension system is an integrated, applied R&D and technology delivery system. Given its reputation for success, it is not surprising that Federal agencies have tried to copy the system in order to improve upon their own research utilization programs. The problems encountered by the agricultural extension system and its imitators hold lessons, and raise questions, for policy-makers concerned with these functions. Some of these emerging lessons are shown in Table 2.

Implications for Action

We draw the following conclusions on the basis of our analysis (1) of the agricultural extension services in the United States, and (2) of the five federal programs in the U.S., and the two programs in less developed nations:

1. You cannot utilize research effectively unless you know what you want to utilize it to do. The goals of the agricultural extension services were fairly direct and unambiguous--to produce more food and to raise farm incomes (although different priorities may be assigned to these goals). In education and in rehabilitation, the goal situation is much more complicated. There are often multiple, conflicting goals--not only between parts of the organization, but within the potential adopting unit as well. So the identification of needs is often a particularly frustrating process. Unless there is some consensus about what outcomes are

Table 2. Main Elements of the Agricultural Extension System Compared to those of Its "Extensions".

Main Elements in the Agricultural Extension Model	Cooperative Extension Service (U.S.D.A.)	Research Utilization in Vocational Rehabilitation (SRS)	Educational Extension Efforts (OE)	National Diffusion Network (OE)	Agricultural Extension in Developing Nations	Family Planning in Developing Nations	Technology Utilization Program (NASA)	OSTS (U.S. Department of Commerce)
1. A critical mass of new technology	Technology with a clear payoff, and understandable connections with previous practice	Technology oriented to new services	Technology developed from theory	Technology developed from practice	Technology with payoff, but expensive and inaccessible	Yes, but contraceptive technology not very perfect	Yes, as a spin-off from space research	Not a well-defined mass of technology.
2. A research sub-system oriented to utilization	Yes, due to reward system for researchers	No	No	Yes, as R&D is conducted by D/D's	Somewhat	Somewhat	Yes, as part of NASA's charter	No
3. A high degree of user control over the research utilization system	Yes, through county planning councils	No	No	Yes, as R&D is conducted by D/D's	No	No	No	No
4. Structural linkages among the research utilization system's components	Yes	No	Yes, with help of ERIC	Yes, between D/D's and adopting schools	No, extension service relatively unconnected with researchers	No	No	No

Table 2. Continued

Main Elements in the Agricultural Extension Model	Cooperative Extension Service (U.S.D.A.)	Research Utilization in Vocational Rehabilitation (SRS)	Educational Extension Efforts (OE)	National Diffusion Network (OE)	Agricultural Extension in Developing Nations	Family Planning in Developing Nations	Technology Utilization Program (NASA)	OSTS (U.S. Department of Commerce)
5. A high degree of client contact by the linking subsystem	Yes, agent: client ratio of 1:500	No	Yes, in a pilot project	A reasonable client ratio	No, hopeless client ratios	Usually	No	No
6. A "spannable" social distance across each interface between components in the system	Yes	Yes	Yes	Yes, as both D/D's and adopters are peers	No, wide soial distance of agents from farmers	Yes, from field workers to clients, but not from field workers to higher officials	No	No
7. Evolution as a complete system	Yes	No, SRS already existed	No	No	No	Yes	No	No
8. A high degree of control by the system over its environment	Yes, e.g., through the AFBF	No	No	No	No	No	No	No

desirable, it is not likely that the search for methods of reaching such outcomes will be very efficient. Research must be utilized to reach a specific goal that is agreed upon by the extension system and by its clients.

2. Society generally believes in research, and is willing, within limits, to support it. To a substantial degree, the justification for research (particularly government-sponsored research) is not to obtain scientific results, but to gain benefits from the process of having it conducted. Research serves as a potent political symbol (Edelman, 1964), substituting for concrete action in settings where such action might have undesirable consequences or where actions cannot be agreed on by the political structure. Thus utilization becomes in a sense an unintended by-product, and often one of fairly low priority. The difficulty of specifying operational problems in research terms because of the lack of research training and interest on the part of operating officials, and because of the intractability of the multiple-goals problem, reinforces this lack of interest in the consequences of research beyond its conduct. Thus there are substantial dynamics working in many federal agencies to maintain the present relationships of research and operations, and to avoid directly facing the problem of research utilization.

An extension-service-utilization model may represent an admission that research was conducted without much prior view as to who might use the outputs, and hence some possible embarrassment may be involved. Thus the differences between why private firms usually (although not necessarily) conduct research (to answer questions), and why governments conduct research (to be seen to engage a problem), may explain fundamental differences in their attention to research utilization.

3. The agricultural extension services begin with users' needs and problems, and the system operates to find useful information to meet these needs, while the SRS and OE illustrate an opposite approach of conducting research largely in answer to researchers' needs, and then attempting to find some use for the results. Naturally, the research topics usually do not match up with users' needs. An effective research utilization system must begin with users' needs.

4. The SRS, OE, OSTS, and TUP attempts at extension consisted mainly of replicating the state-level specialist in the agricultural extension model, rather than also copying the county extension agent. The SRS RUS and the OE educational extension agent actually worked mainly with professional staff as their clients for change, not with rehabilitatees and school children, respectively.

5. The Social and Rehabilitation Service, the U.S. Office of Education, the U.S. Department of Commerce, and NASA did not grasp the full scope of the agricultural extension model as they perceived it as only an innovation-diffusion system rather than a complete research utilization system. In other words these federal agencies ignored the fact that the extension services are only one component in the land grant university/agricultural experiment station/extension service complex.

6. The main difference between the agricultural extension model and the social-service and industrial programs that followed

the model are not that potential adopters are nested in organizational settings, but that the nature of the innovations to be adopted implies that an individual cannot adopt without carrying the rest of the organization along with him. This is somewhat true in the education case, especially so in the rehabilitation and industrial cases and partly characteristic of family planning.

The choice of the cases that we analyzed here-in was based in part on our interest in evaluating the extensions of the extension model (1) cross-culturally, outside of the U.S., and (2) from individual to organizational units of decision-making.

National Setting	Unit of Innovation Decision-Making		
	Individual		Organization
U.S.	Agricultural Extension Model →	(1)	Social and Rehabilitation Service
	↓	(2)	U.S. Office of Education
		(3)	OSTS
		(4)	NASA's TUP
Developing Countries	(1) Agricultural Extension (2) Family Planning		

Of these case analyses, we judge that the relative degree of success of the agricultural extension model when applied to the new situation was probably greatest for family planning, somewhat less for the U.S. Office of Education's educational extension agent program, and least for SRS, OSTS, and NASA's TUP in the U.S., and for agricultural extension in developing nations. Why?

7. The relative success of these extensions of the agricultural extension model is due to more extensive modification of the model to fit its new application.

The agricultural extension model depends on a particular combination of elements: Type of technology, incentives, close social distance of agents to clients, administrative relationships, etc. In any given situation, some of these elements are manipulable, and some are not. The process of applying the model effectively relies on having the non-manipulable factors close to the demands of the model, and of arranging the manipulable factors into that pattern. If either of these demands cannot be met, the model will fall short of expectations. Thus the non-manipulable elements form a limit to the applicability of the agricultural extension model, and the manipulable elements form a ceiling composed of the skill and will of the implementers.

Implications for Future Research

The present report represents only some first steps in investigating the relationships between the agricultural extension model and a variety of subsequent information-diffusion activities. The comparative systems-analysis approach used in this report provides a convenient approach for the type of hypothesis-generation we have here sought.

Many fruitful angles of approach to this problem of diffusion remain to be explored. For example, a detailed econometric analysis might be undertaken in order to determine with greater precision just how much of the change in U.S. agricultural productivity may properly be attributed to the efforts of the Cooperative Extension Service. Recent work in the use of time-series analysis in causal modelling might be useful. We have in this report only been able to suggest some of the factors which might go into such an analysis, and note general patterns of change among such factors.

Comparative analyses might be made of other extensions and variations of the agricultural extension model: Government technology transfer to private industrial firms in developing countries (like COLCIENCIAS in Colombia, SIET in India, technology development institutes in Indonesia and in Korea), and in developed nations (as in CISRO in Australia); the promotion of specific bundles of educational innovations like modern math and PSSC physics in the U.S., and other similar activities elsewhere.

Certain common problems in extending the agricultural extension model are apparent in our present essay, and certainly warrant more intensive exploration of their dimensions and effects: Client-change agent social distance and the problems in interpersonal communication that usually accompany it; the growing socio-economic gaps within a client audience caused by technological diffusion; and inadequate client ratios for change agents in the face of limited resources for linking activities. These recurrent problems deserve particular research attention in an effort to find practical solutions, unfortunately greater attention than we could devote in the present report.

The general research issue underlying our present work is how research can be utilized in ways that benefit society. We hope that at least some insight has emerged from our present analysis. We hope that our outline of the critical elements of the agricultural extension model itself will stimulate both scholars and administrators to analyze more carefully just which elements of their own programs do and do not relate to the agricultural extension experience, and thus clarify how and why these elements interact as they do. Only out of a body of proven experience such as we have described here-in will we learn what aspects of research utilization really do and do not work.

And the next time that some bright young fellow at a cocktail party proclaims that your agency's difficulties with insufficient research utilization can be solved by simply copying the agricultural extension service....

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Appendix

TRENDS IN AGRICULTURE, RURAL LIFE, AND THE AGRICULTURAL EXTENSION SERVICES

Note: Full citations for all of the following charts are given in the REFERENCES CITED section of the present report.

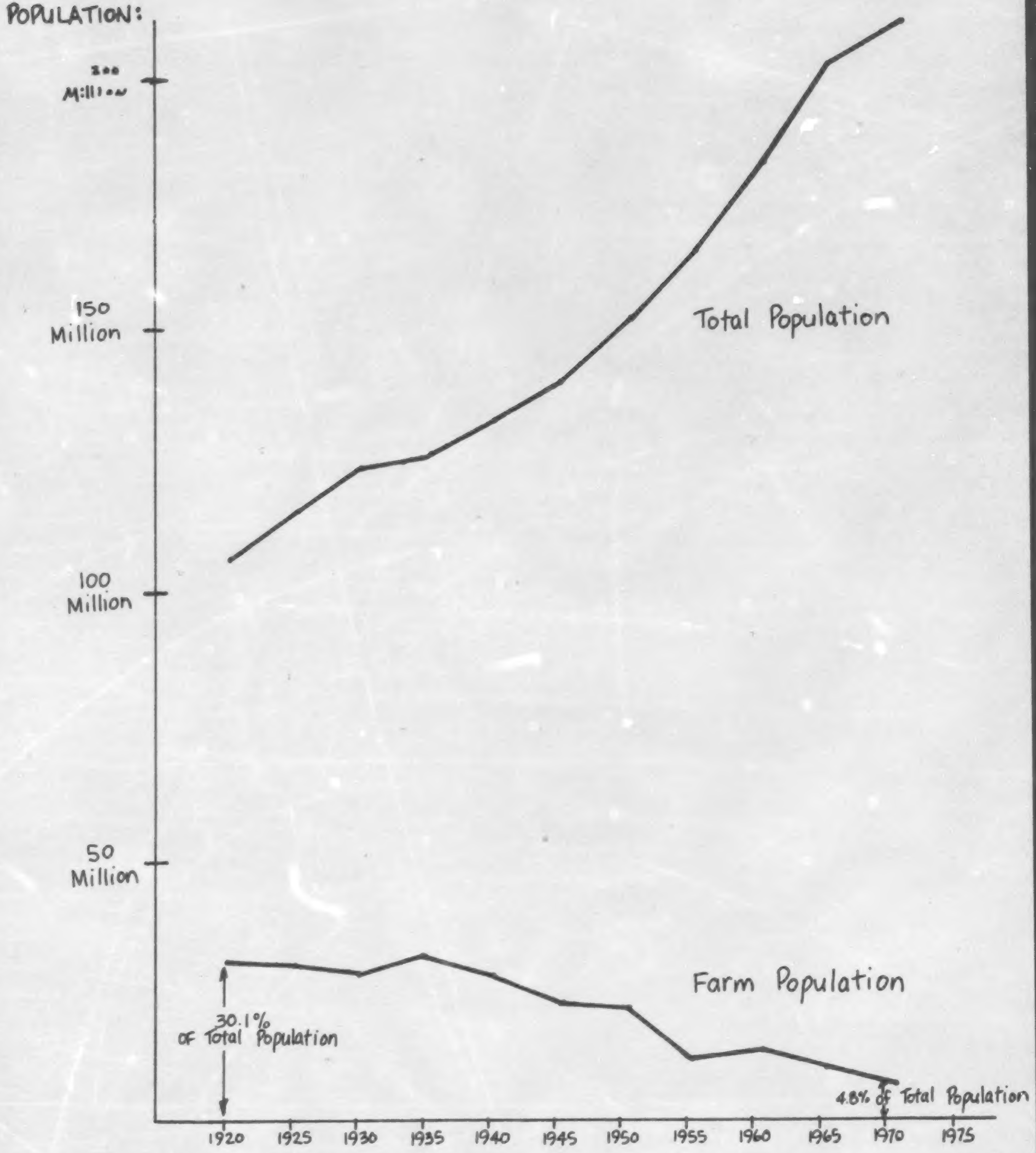


Chart I. U.S. Population Trends, 1920-1970.

Source: Statistical Abstract.

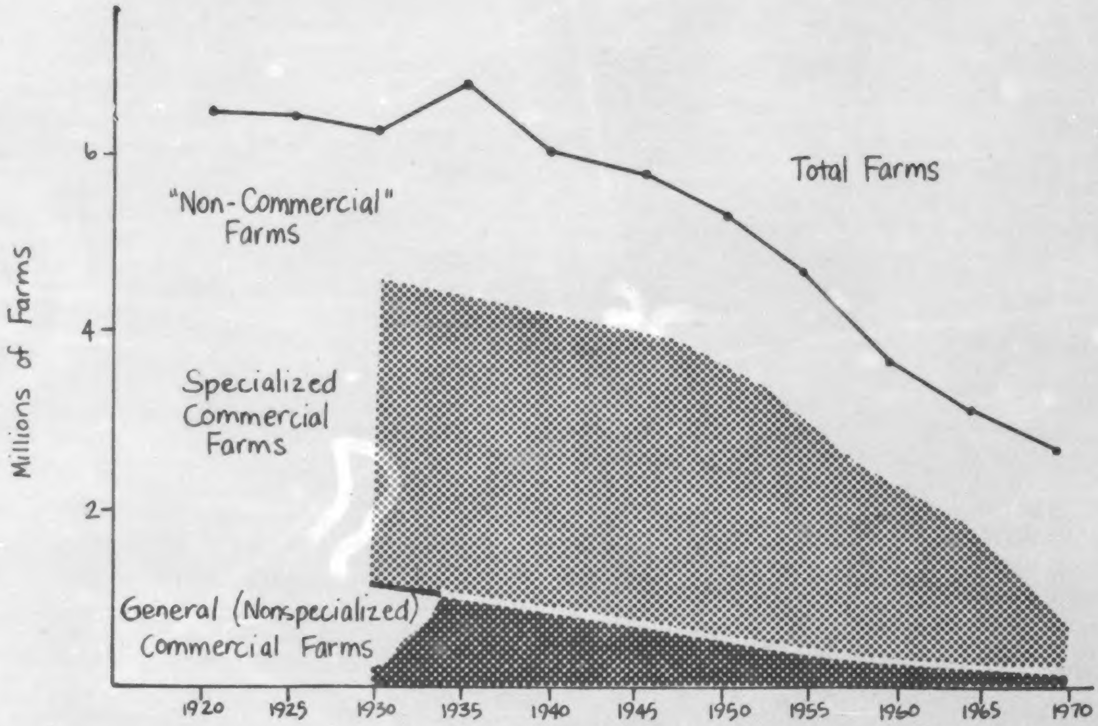


Chart II. Total U.S. Farm Operations by Type, 1920-1970.

Source: Census of Agriculture.

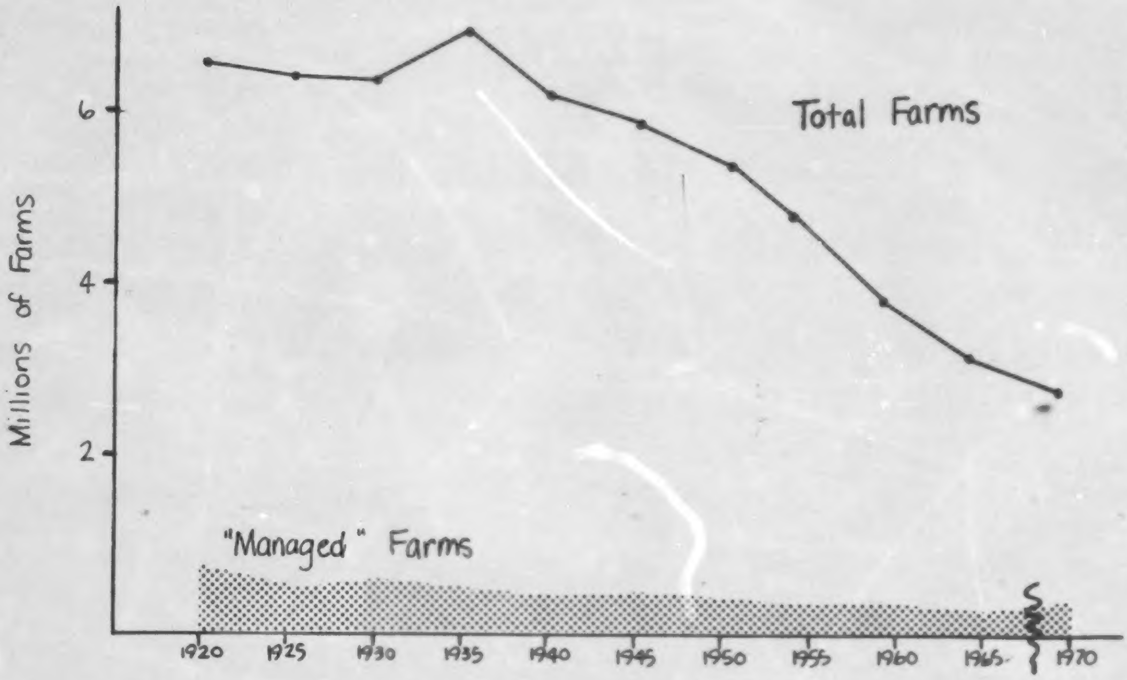


Chart III. Total U.S. Farm Operations by Nature of Management, 1920-1970.

Source: Census of Agriculture.

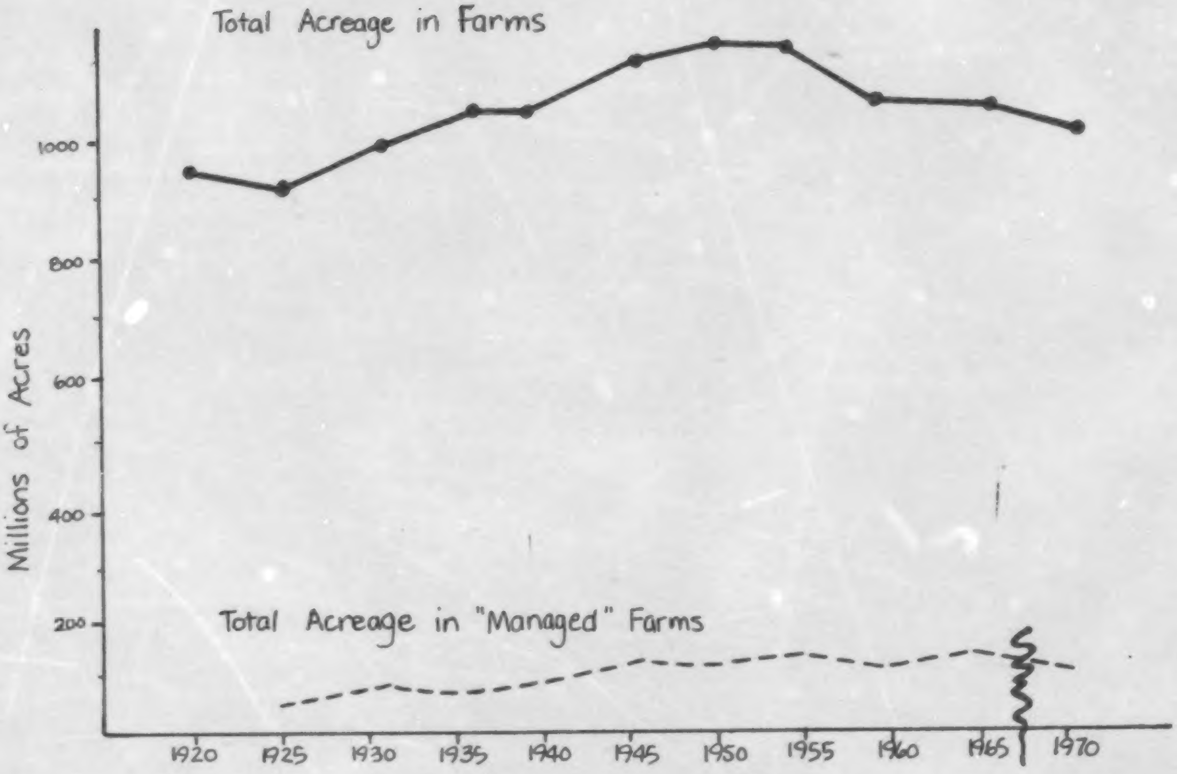


Chart IV. Land in Farms, 1920-1970 : Total Acreage.

Source: Census of Agriculture.

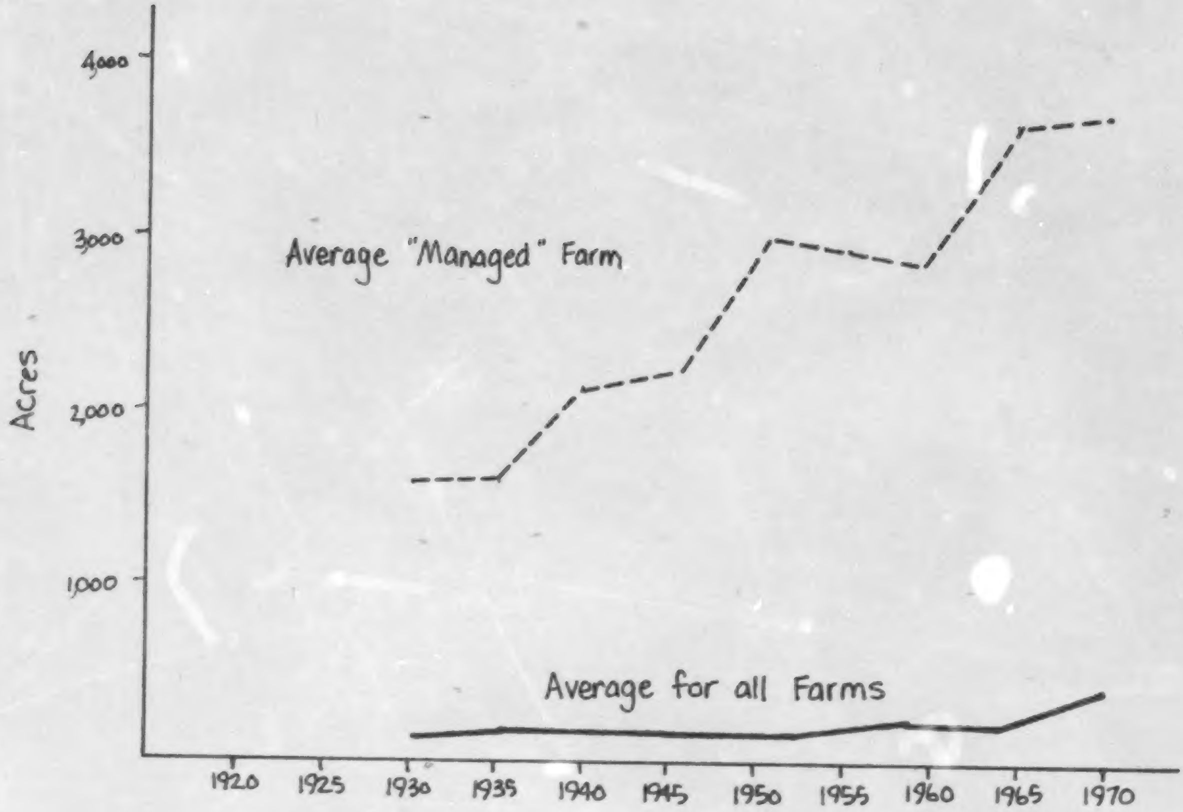


Chart V. Land in Farms, 1920-1970: Average Size.

Source: Census of Agriculture.

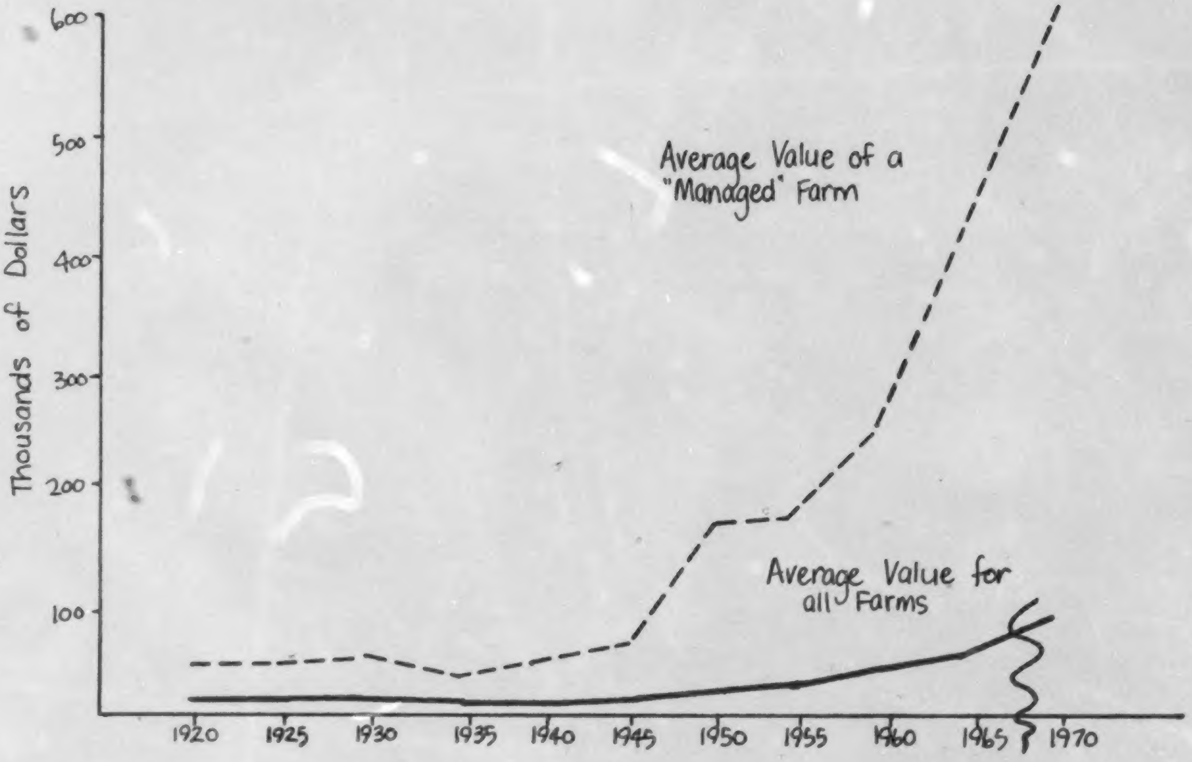


Chart VI. Value of Farms, 1920-1970: Average Value per Farm (land, buildings, equipment).

Source: Census of Agriculture.

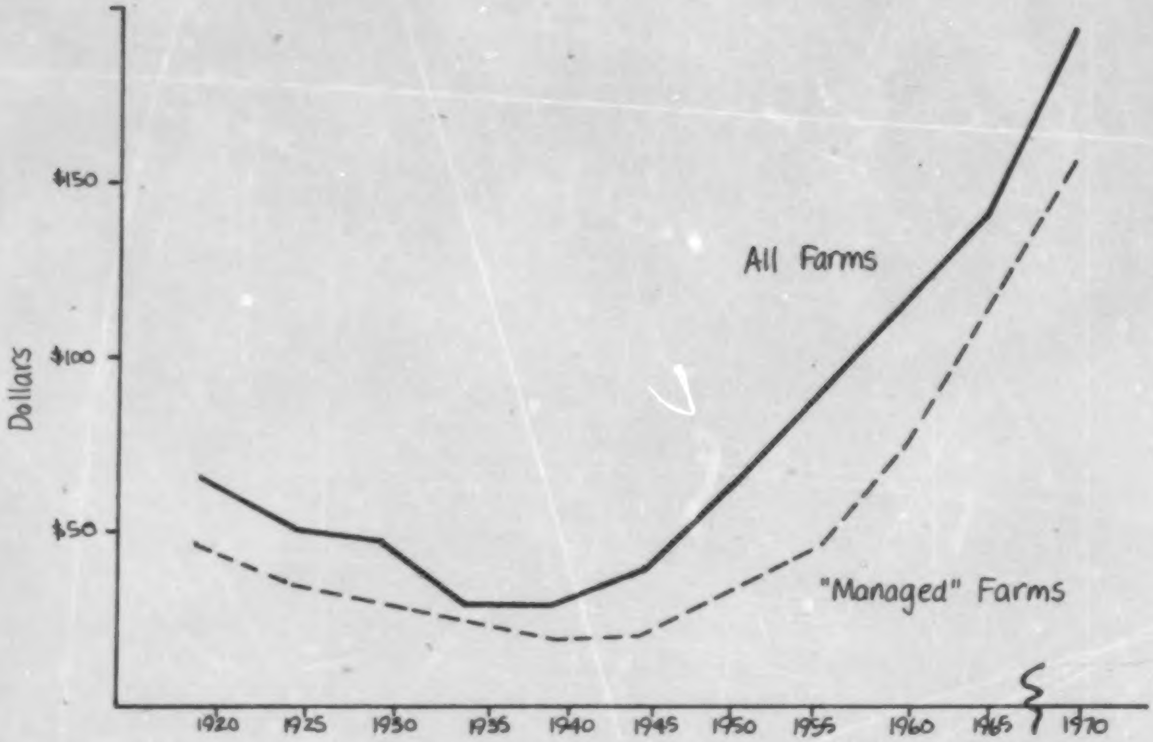


Chart VII. Value of Farms, 1920-1970: Average Value per Acre.

Source: Census of Agriculture.

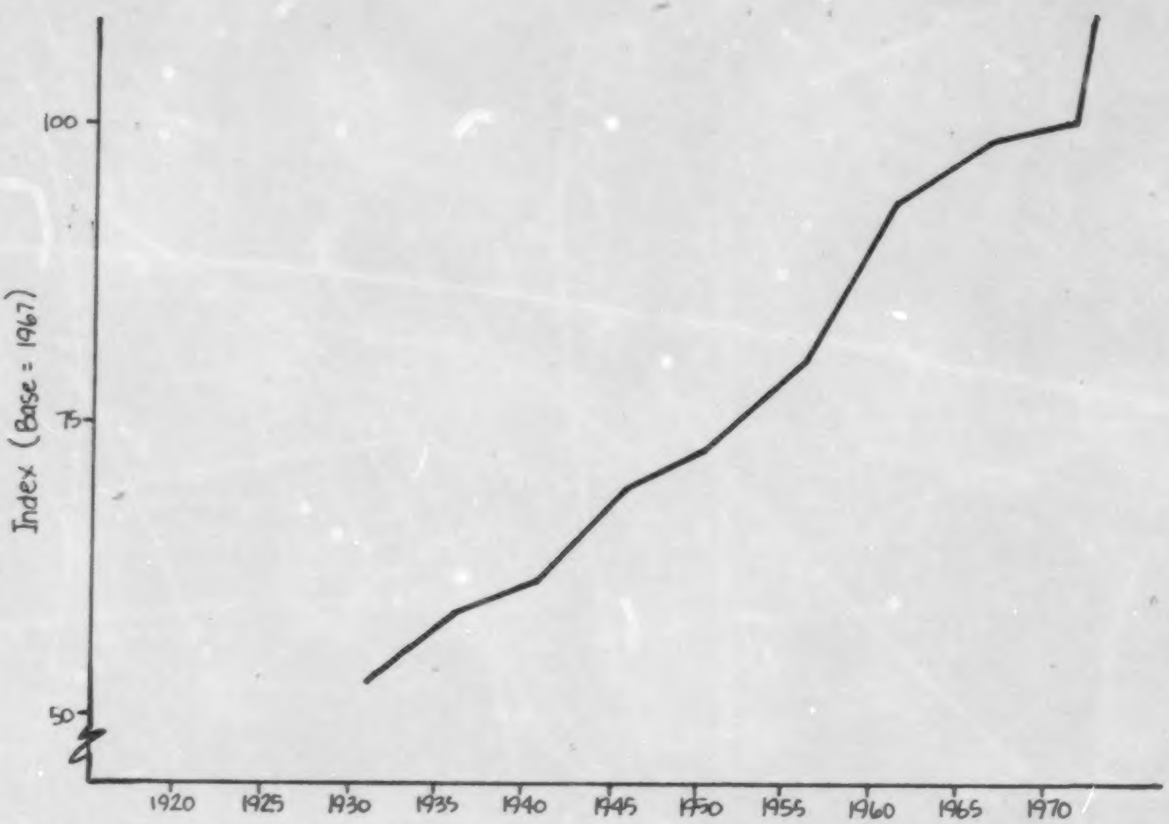


Chart VIII. Components of Agricultural Productivity, 1920-1970 : Index of Total Productivity (Input / Output).

Source: Agricultural Statistics.

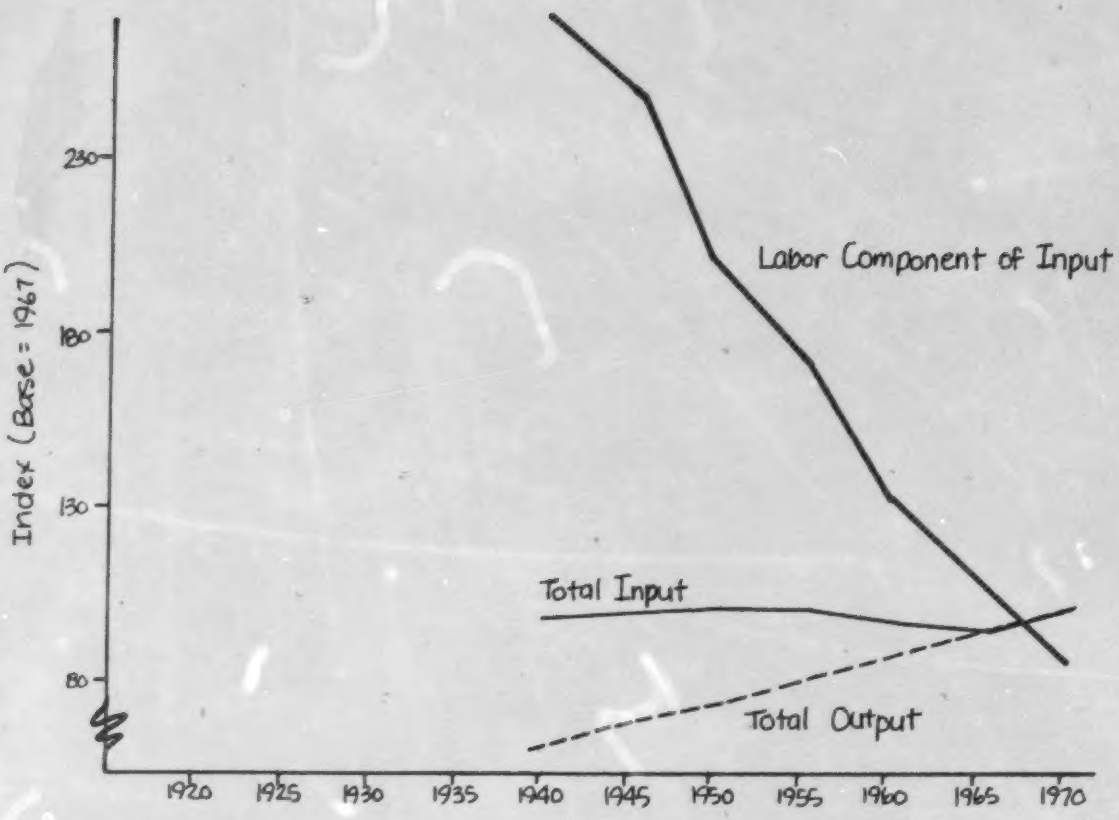


Chart IX. Components of the Index of Total Productivity, 1920-1970.

Source: Agricultural Statistics.

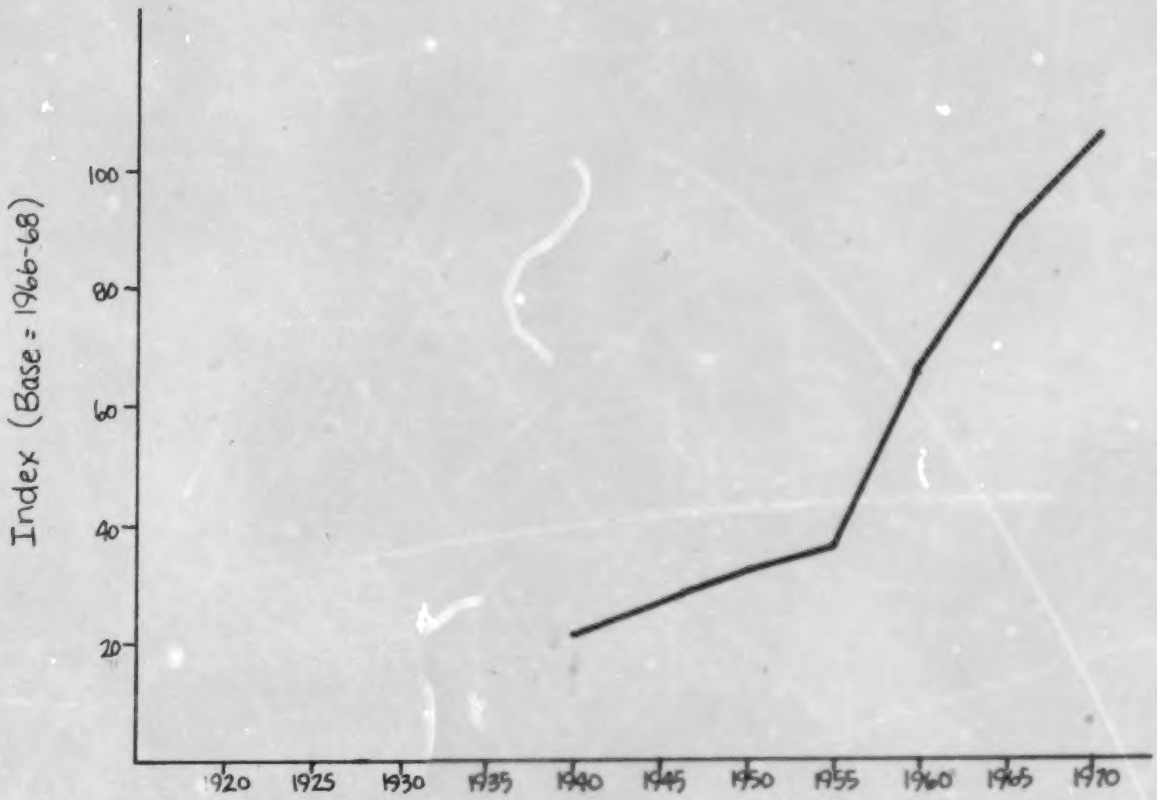


Chart X. U.S. Farm Productivity, 1920-1970: Index of Farm Output per Man-hour.

Source: Agricultural Statistics.

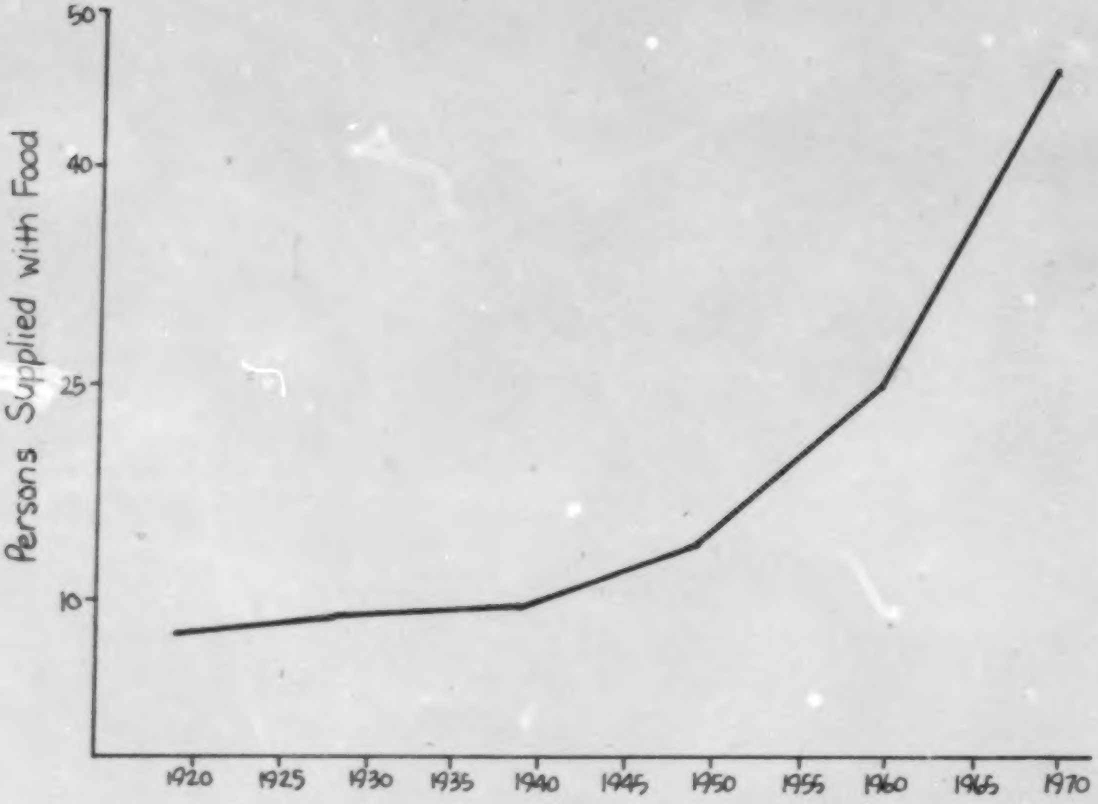


Chart XI. U.S. Farm Productivity, 1920-1970: Persons Supplied with Food for each Farm Worker.

Source: Agricultural Statistics.

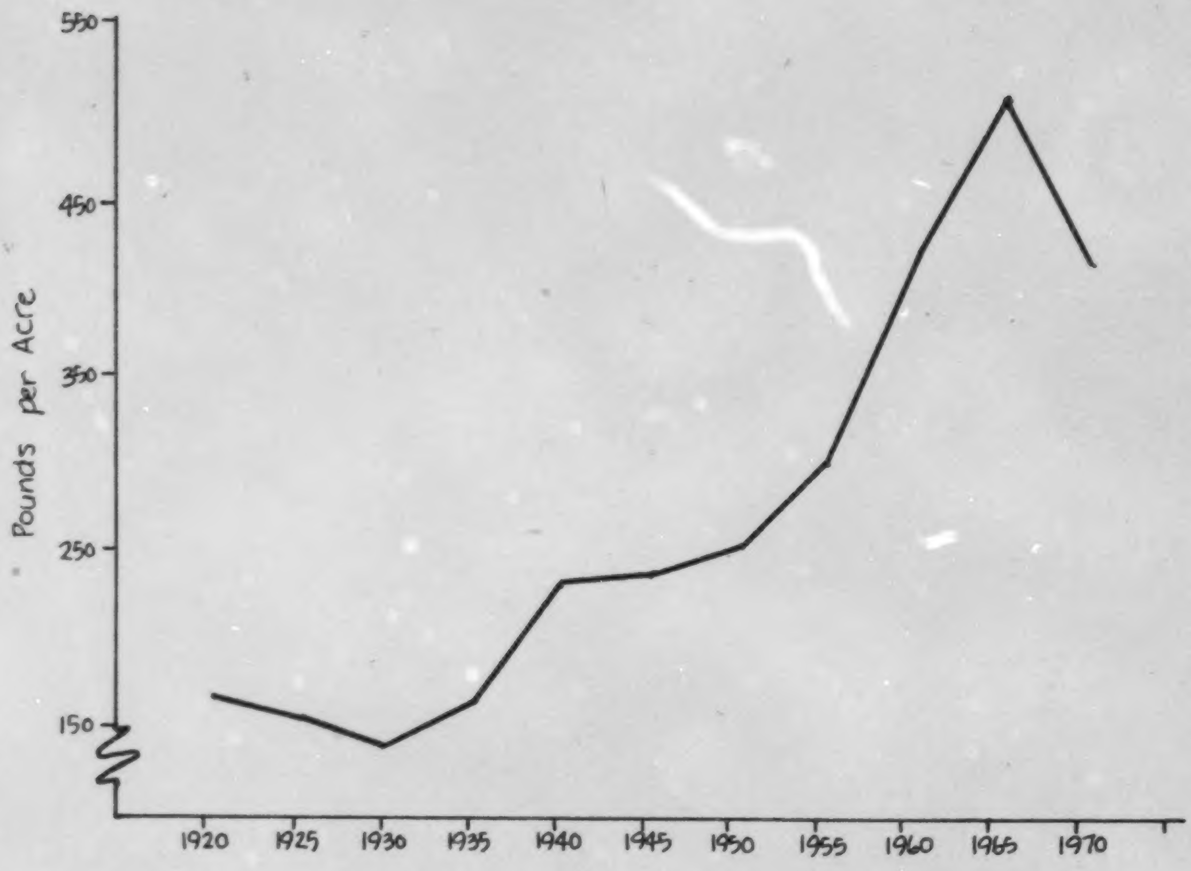


Chart XIII. Productivity as indicated by Changes in Yields, 1920-1970: Cotton Production.

Source: Agricultural Statistics.

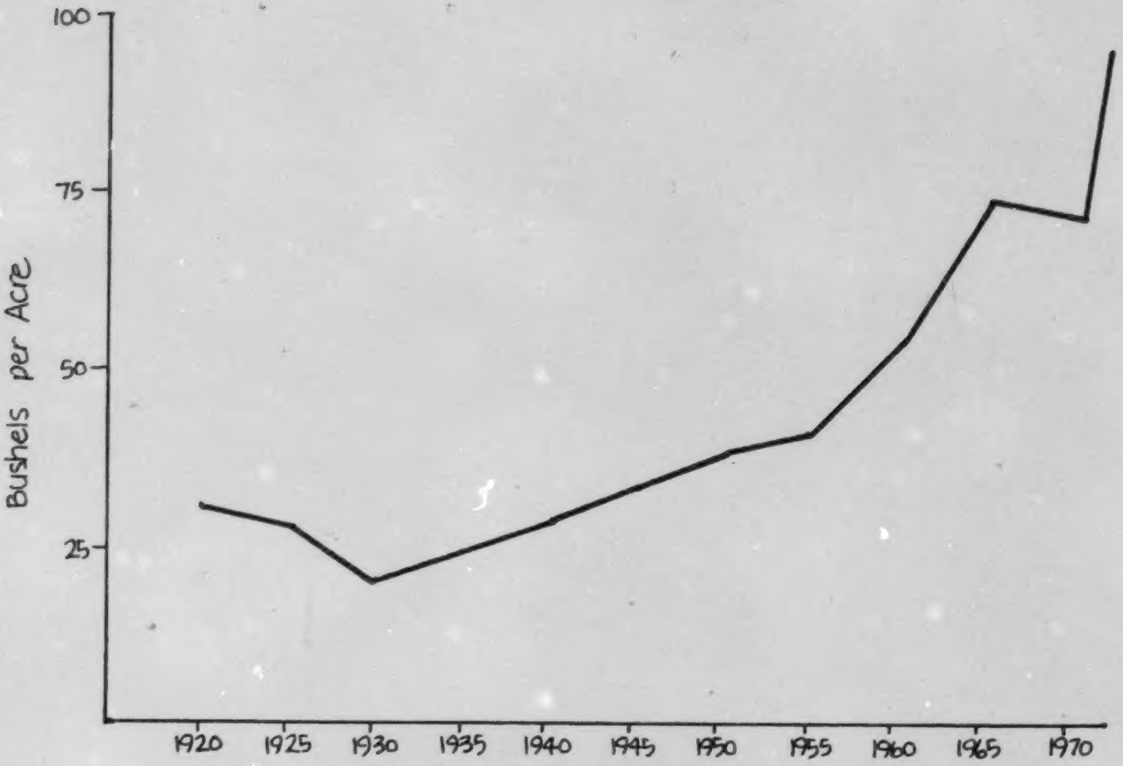


Chart XII. Productivity as indicated by Changes in Yields, 1920 - 1970: Corn Production.

Source: Agricultural Statistics.

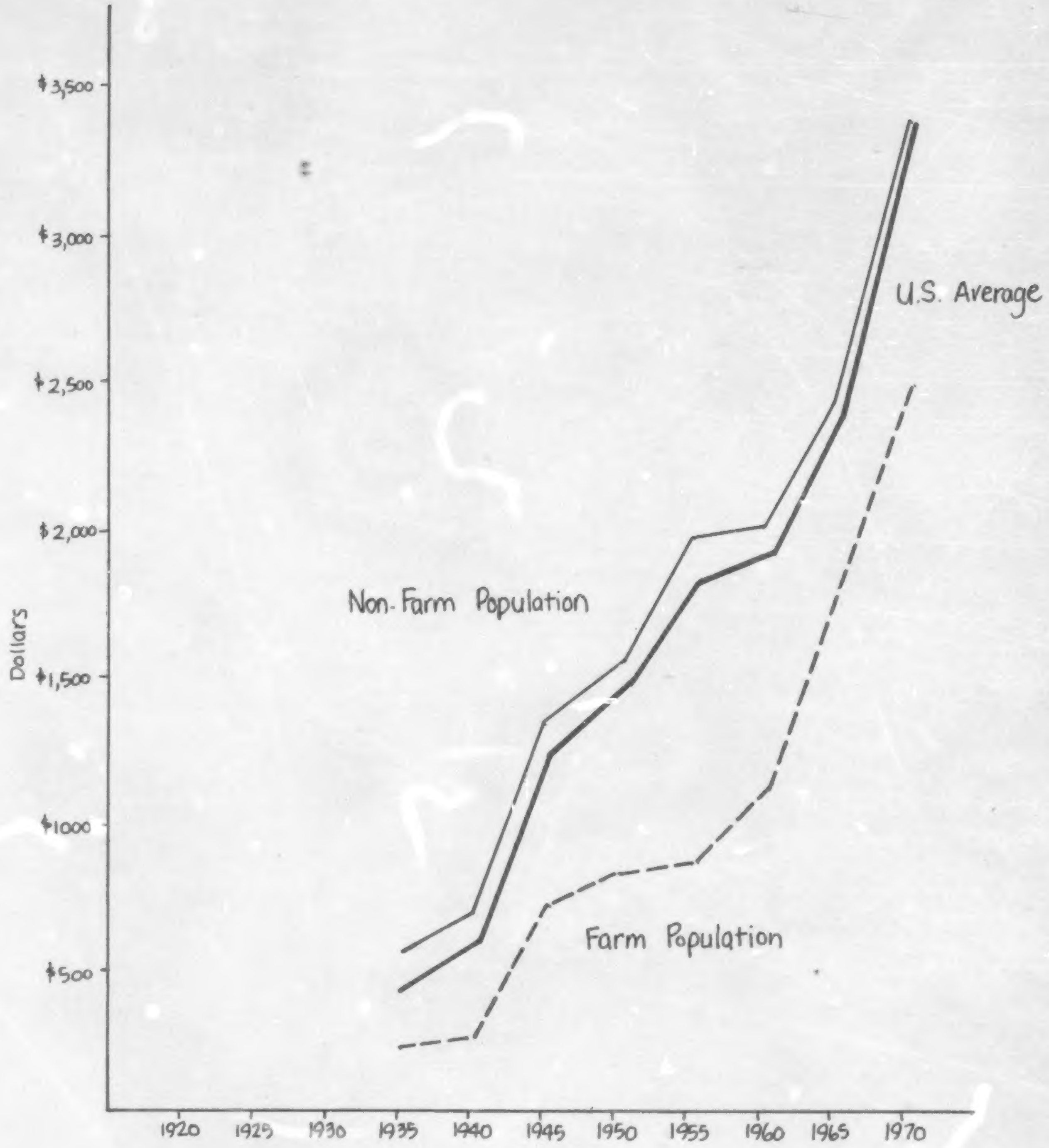


Chart XIV. U.S. per Capita Income, 1920 - 1970.

Source: Agricultural Statistics and Historical Statistics.

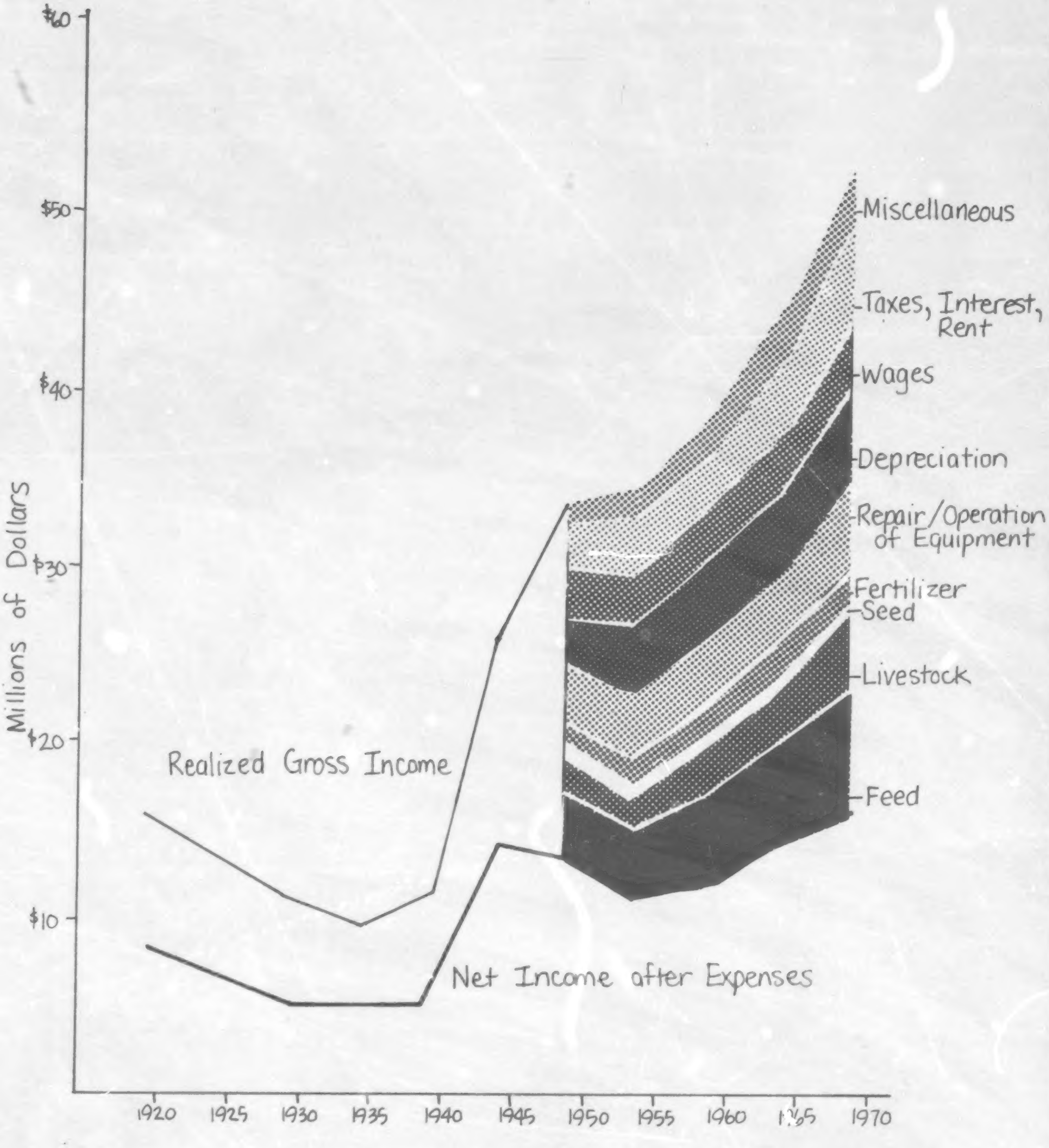


Chart XV. Gross vs. Net Farm Income, with Components of Expenses, 1920-1970.

Source: Agricultural Statistics.

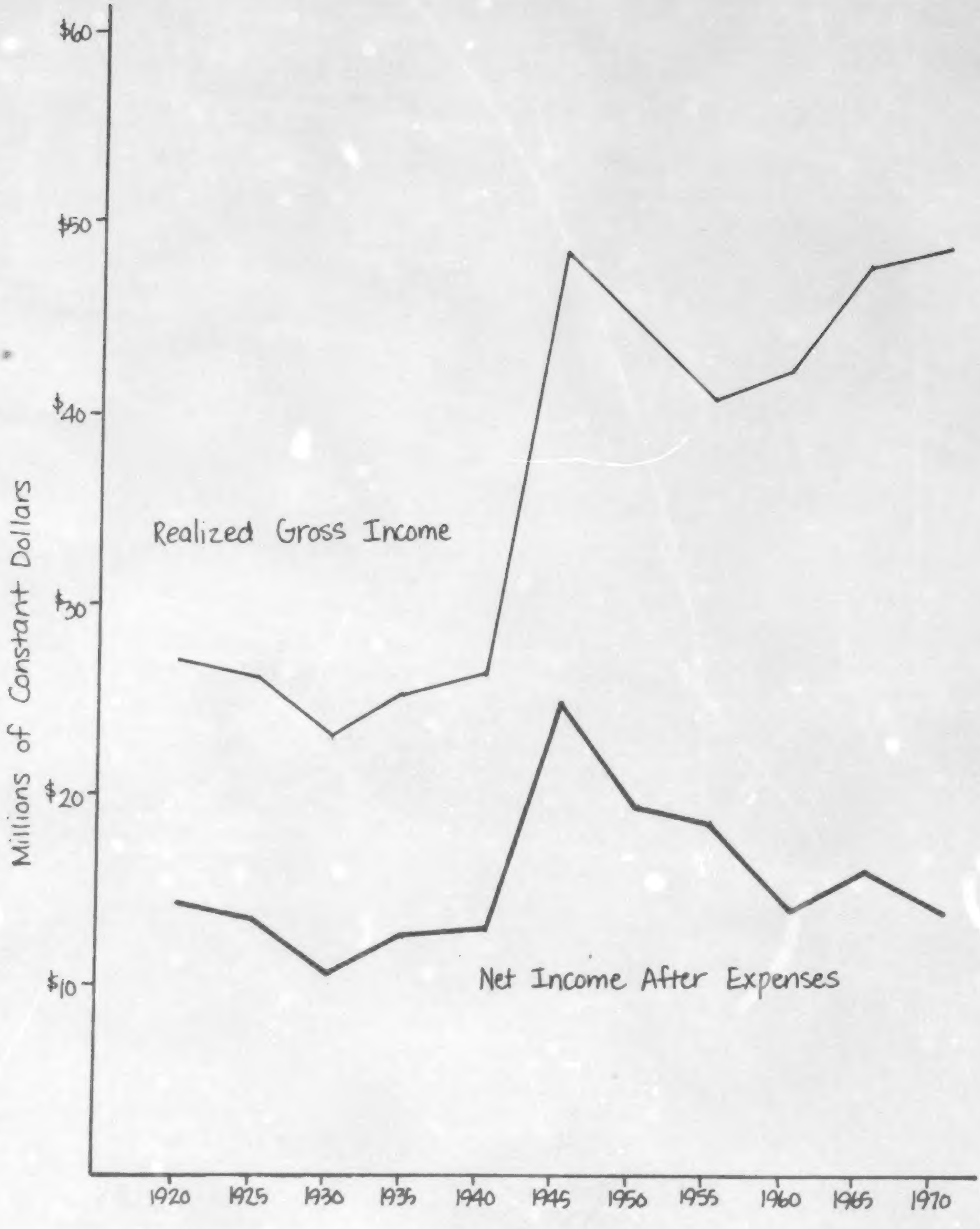


Chart XVI. Gross vs. Net Farm Income in Constant Dollars [Base = 1967], 1920-1970.

Source: Agricultural Statistics.

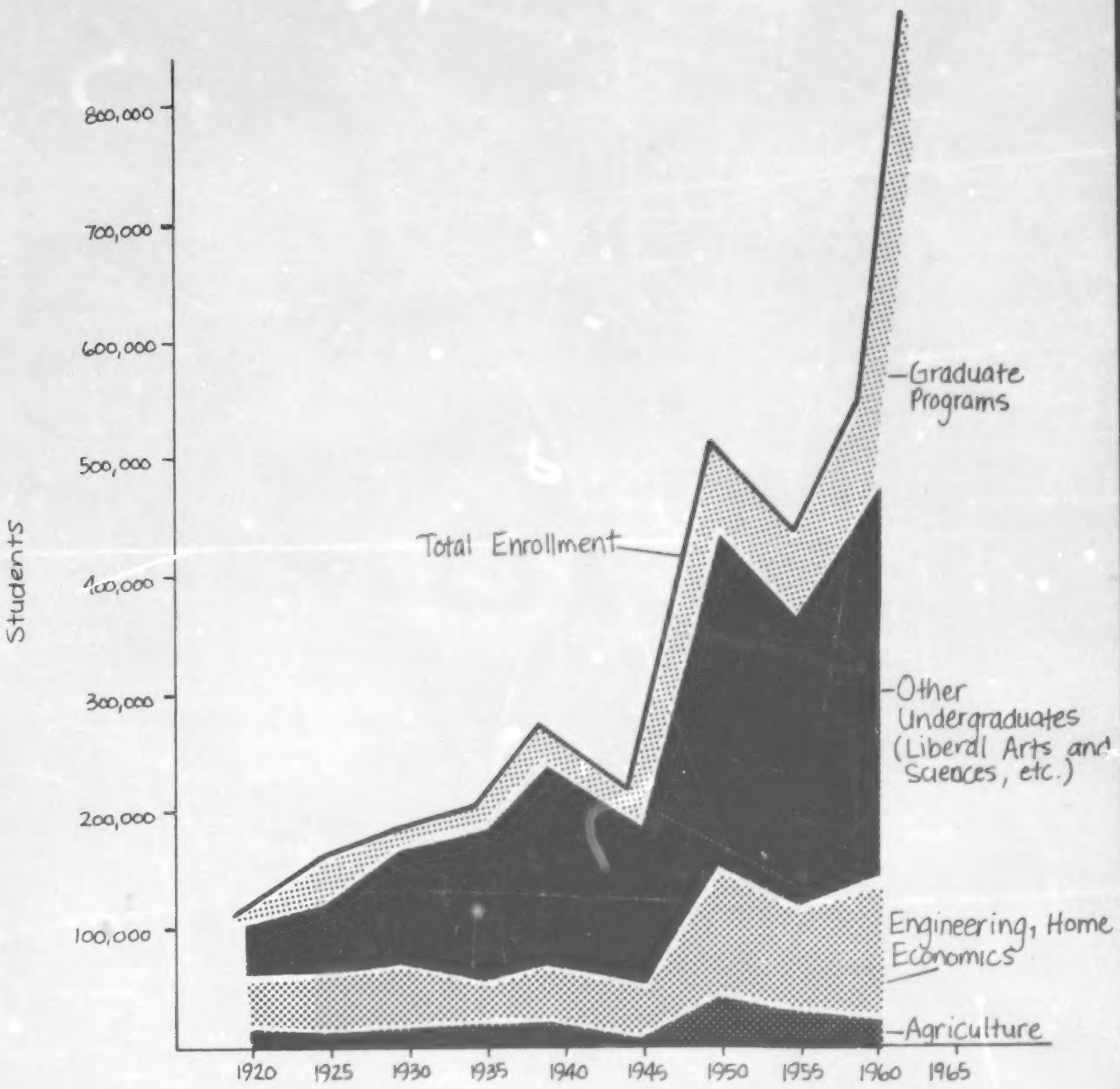
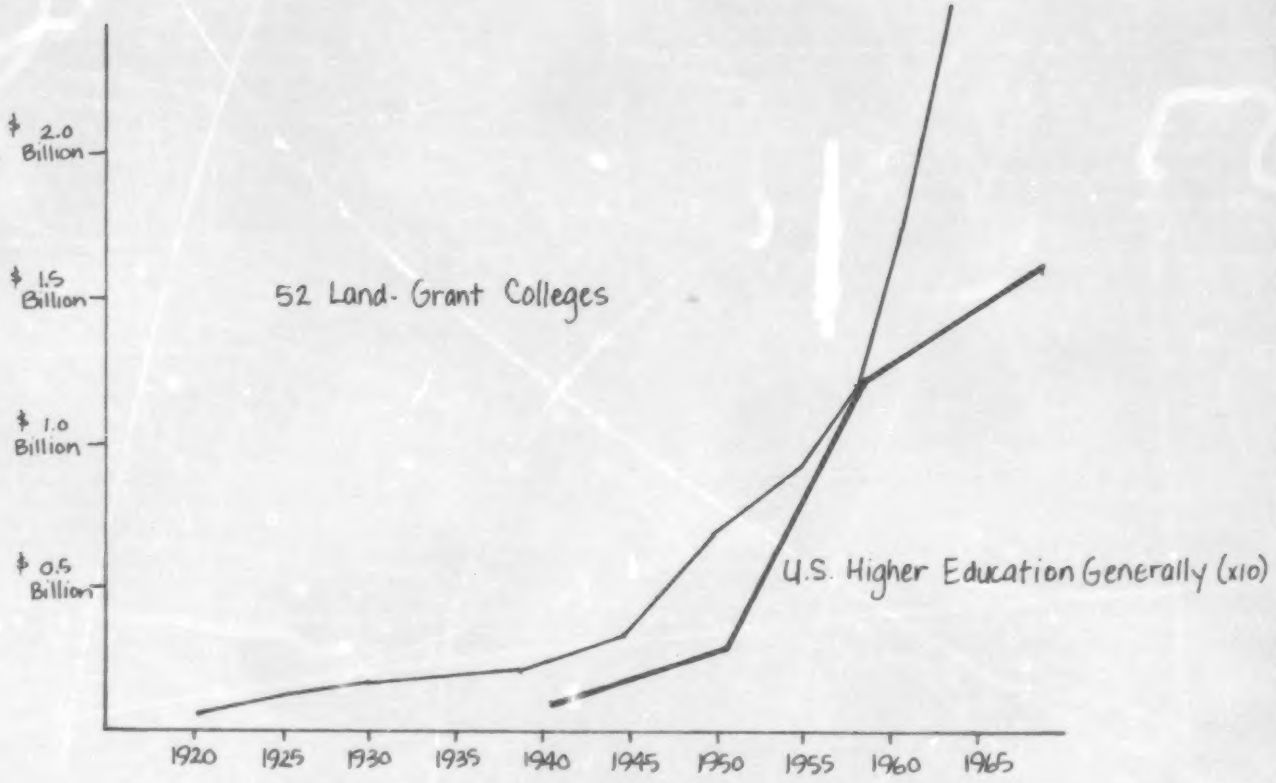


Chart XVII. Enrollment and Program Emphasis in Land-Grant Colleges, 1920-1963.

Source: USOE Bulletin and Circular.



Ch t XIX. Total Money Income of Land-Grant Colleges, 1920-1963.

Source: USOE Bulletin and Circular.

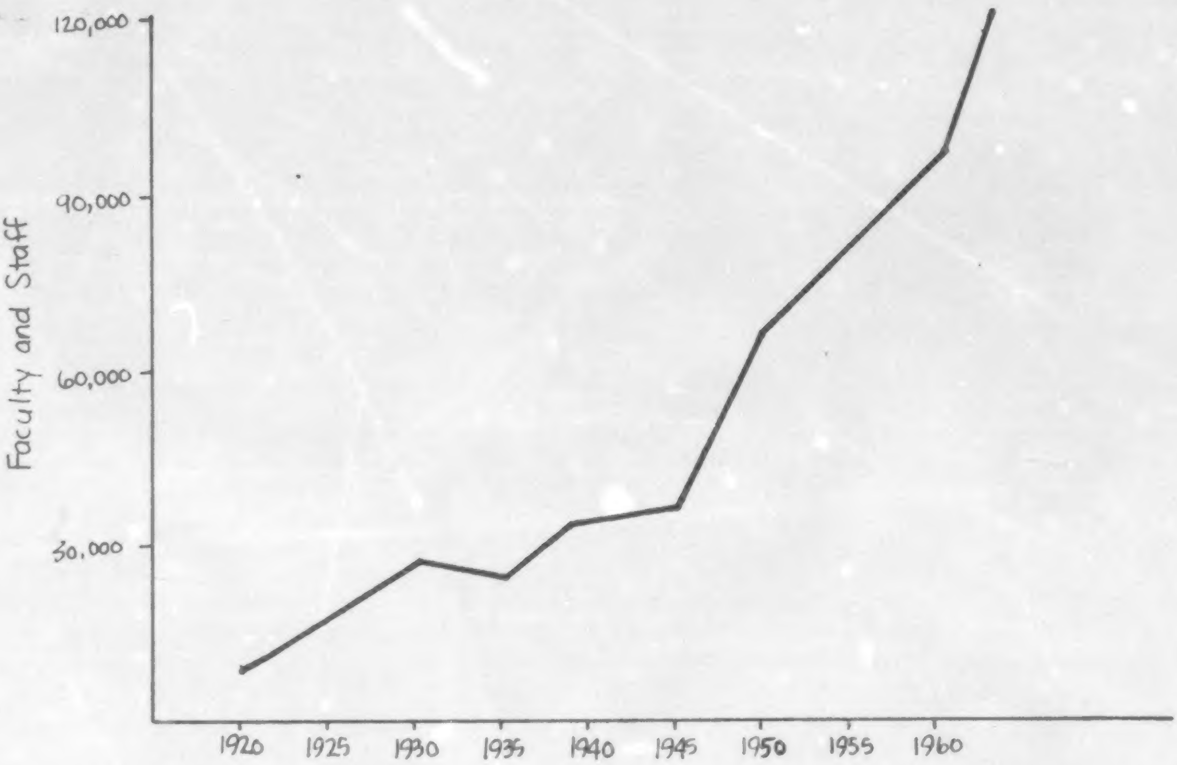


Chart XVIII. Faculty and Staff Positions in Land-Grant Colleges, 1920-1963.

Source: Historical Statistics and USOE Bulletin and Circular.

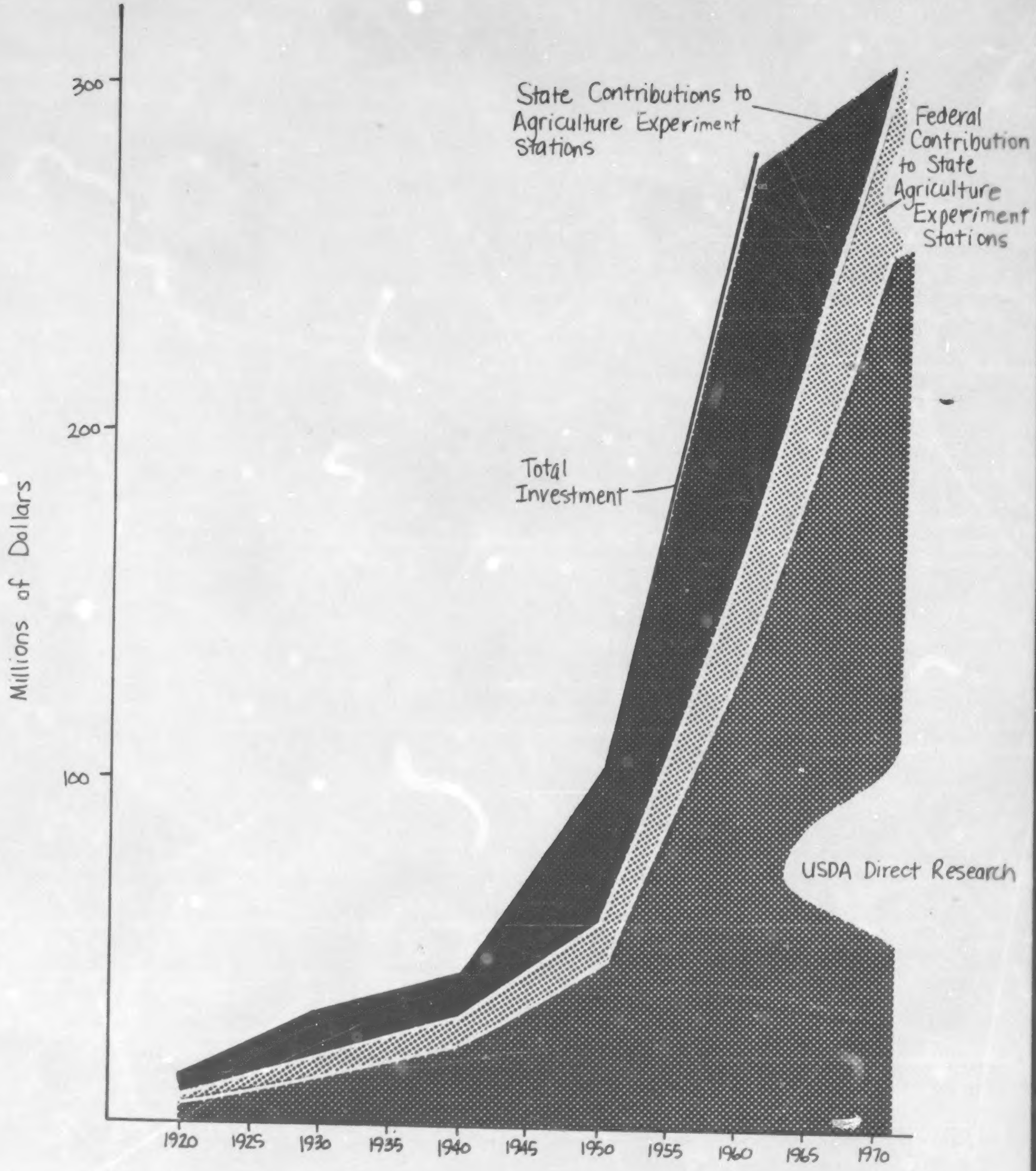


Chart XX. Funds for Public Agricultural Research, 1920-1970.

Source: Sanders (1966).

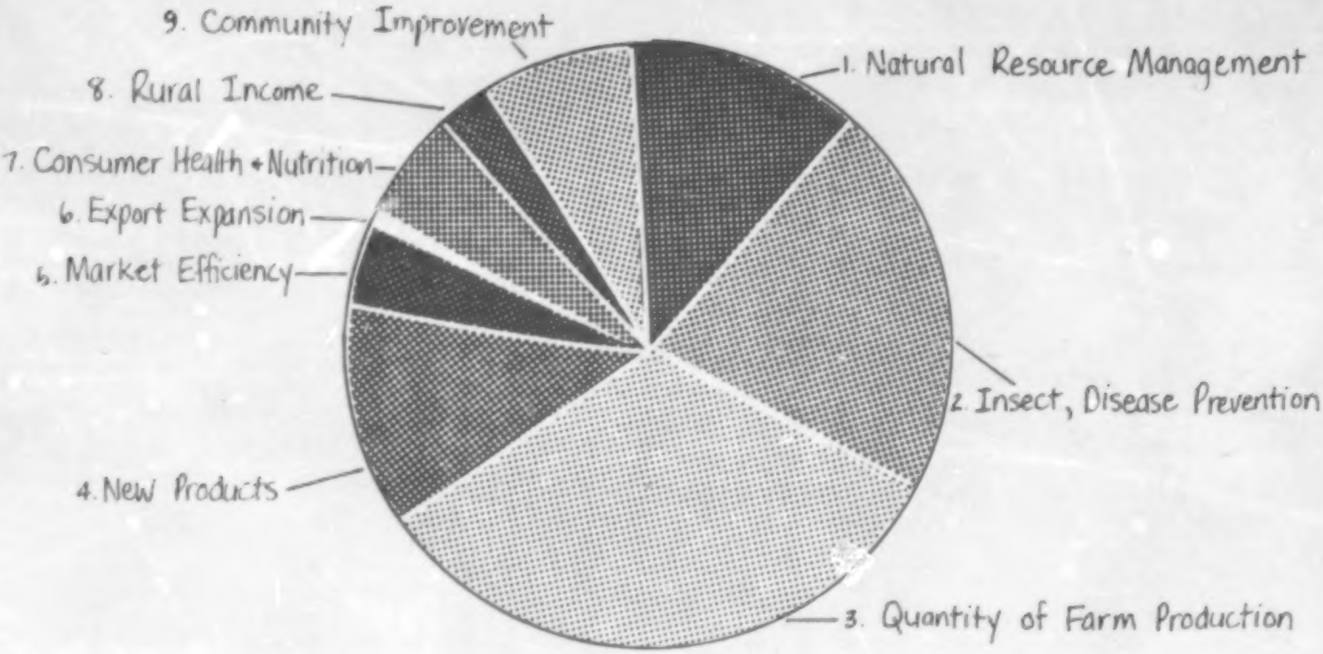


Chart XXI. Distribution of Federal Agricultural Research FY 1973 (Dollars).

Source: U.S.D.A (1970 to 1973), Inventory of Agricultural Research.

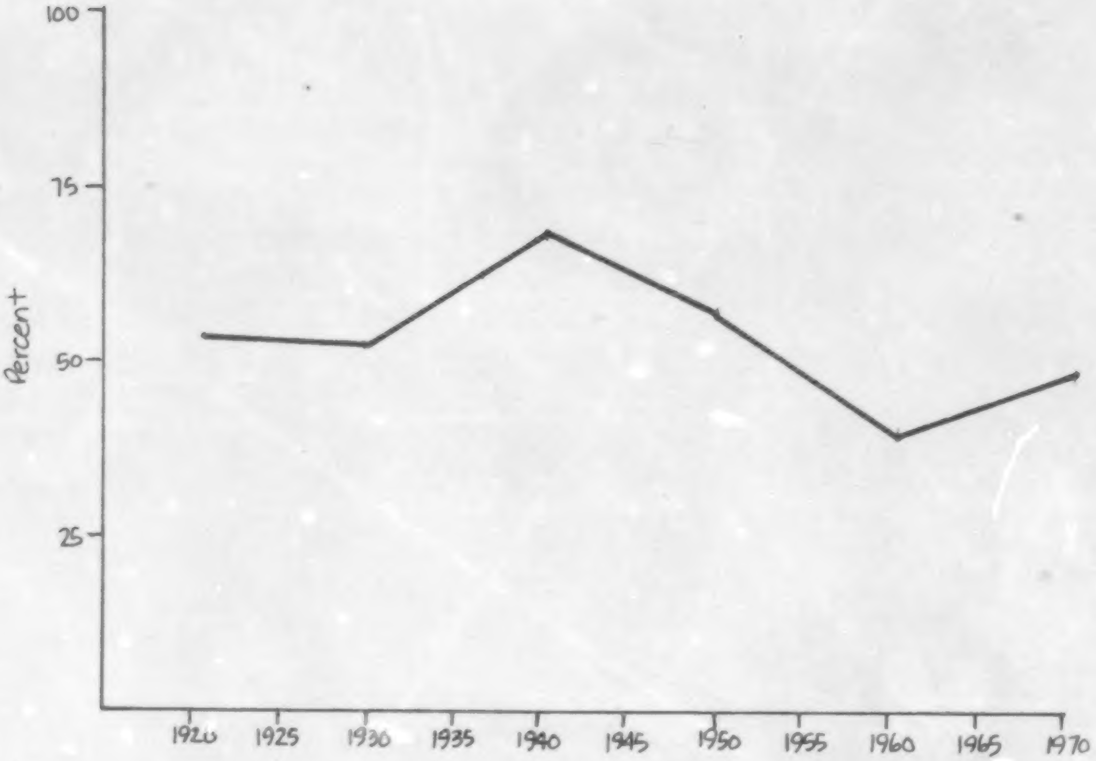


Chart XXII. Federal Investment in Extension as a Percent of Federal Investment in Agricultural Research, 1920-1970.

Source: U.S. Bureau of the Budget (1923 to 1974) and Sanders (1966).

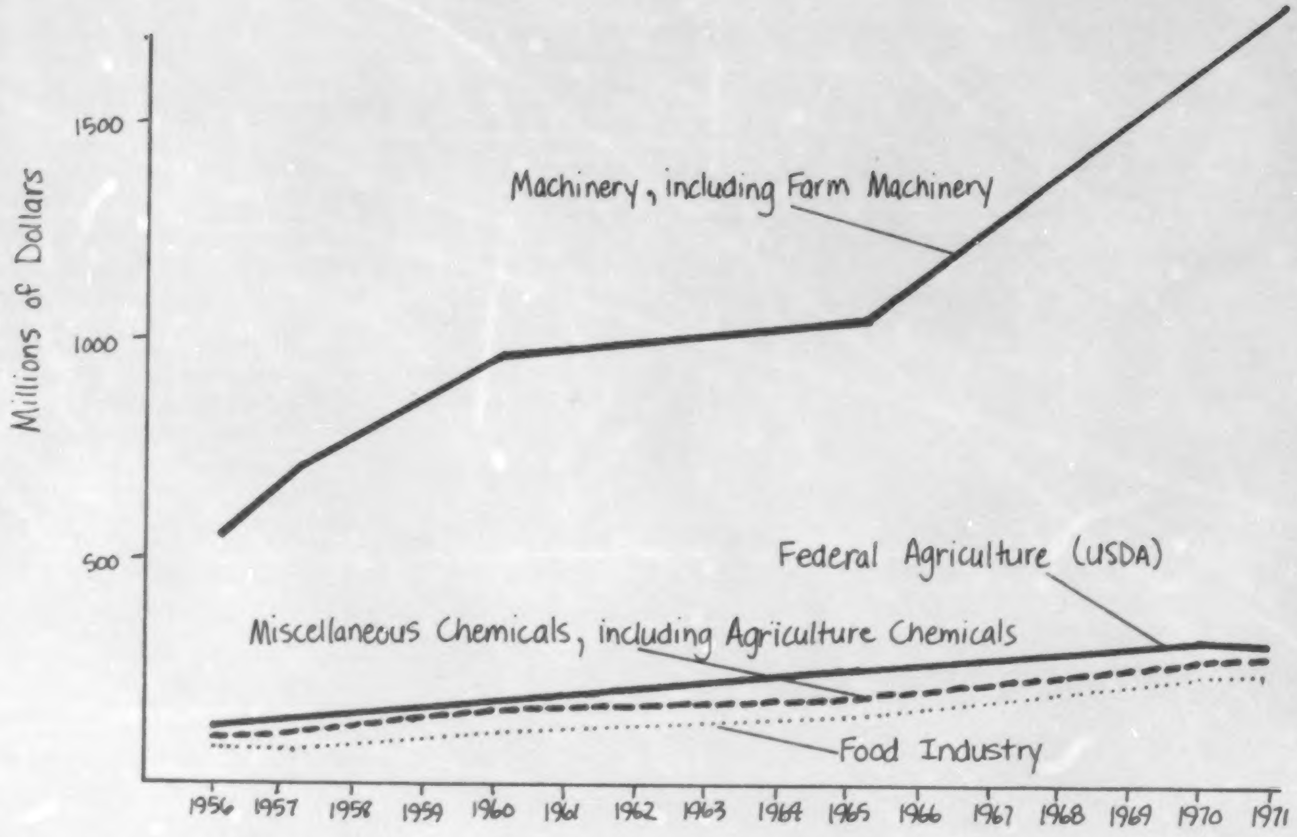


Chart XXIII. Total R+D Expenditures by Industry, 1956-1971.

Source: Sanders (1966) and U.S. National Science Foundation (1957 to 1974).

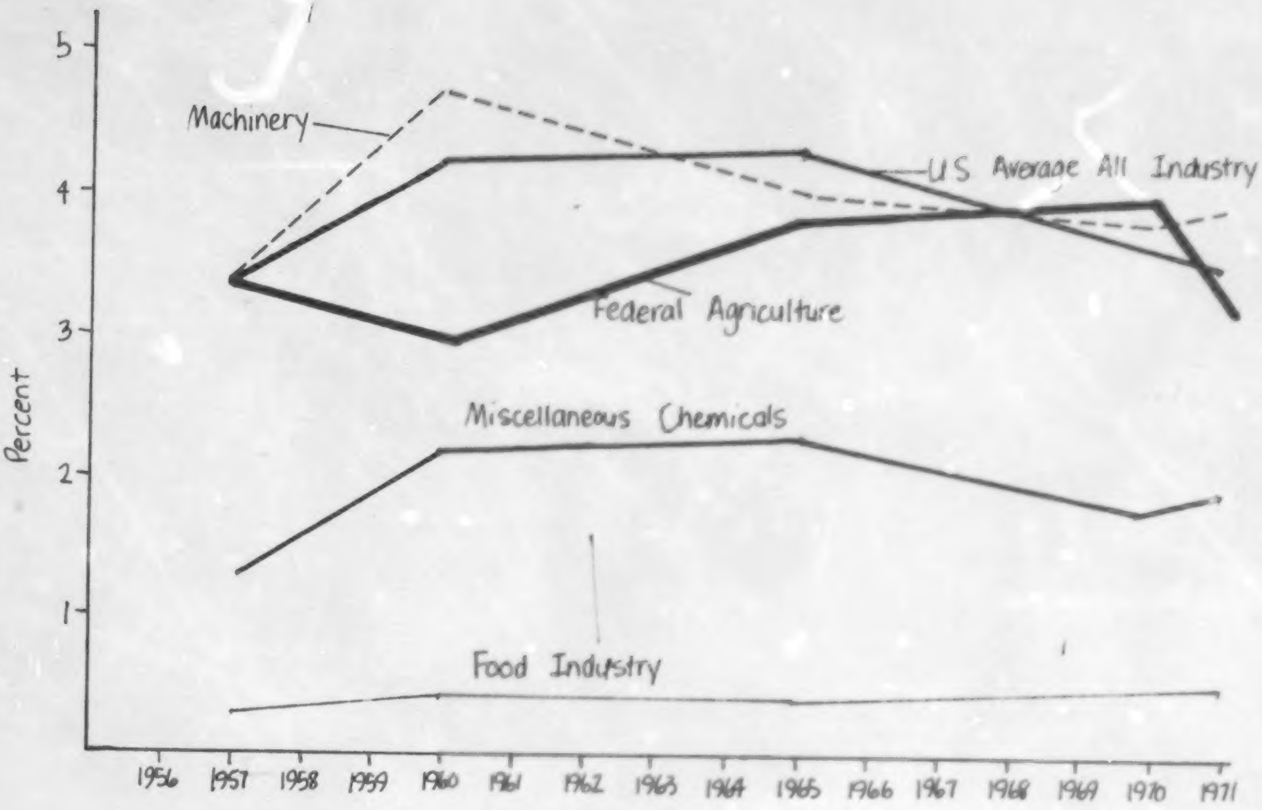


Chart XXIV. R+D Expenditures as Percent of Sales, 1956-1970.

Source: Sanders (1966) and U.S. National Science Foundation (1957 to 1974).

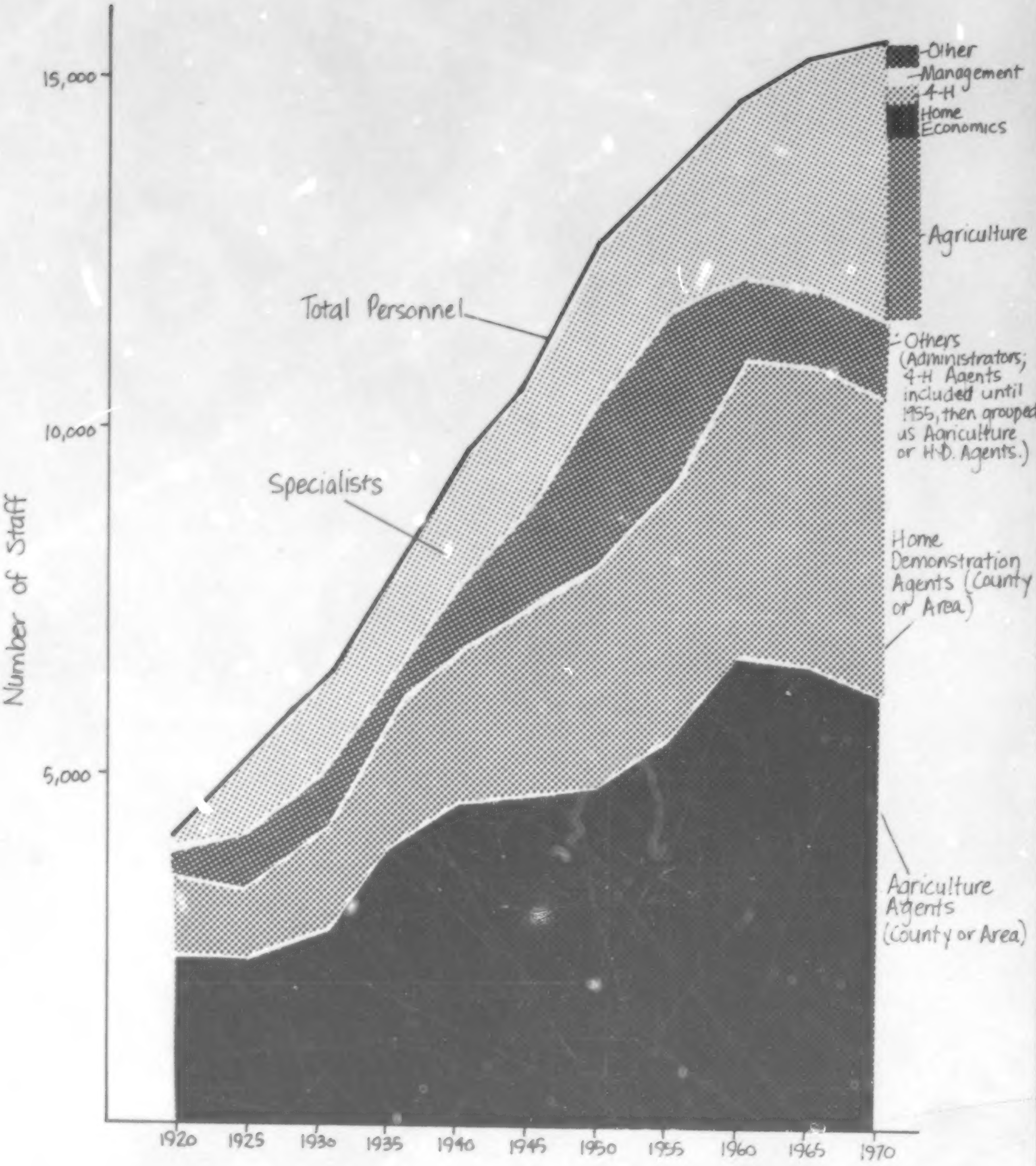


Chart XXV. Agriculture Extension Personnel in the U.S., 1920-1970: with components of the Specialist Group, 1973.

Source: U.S. Federal Extension Service (1931 to 1974).

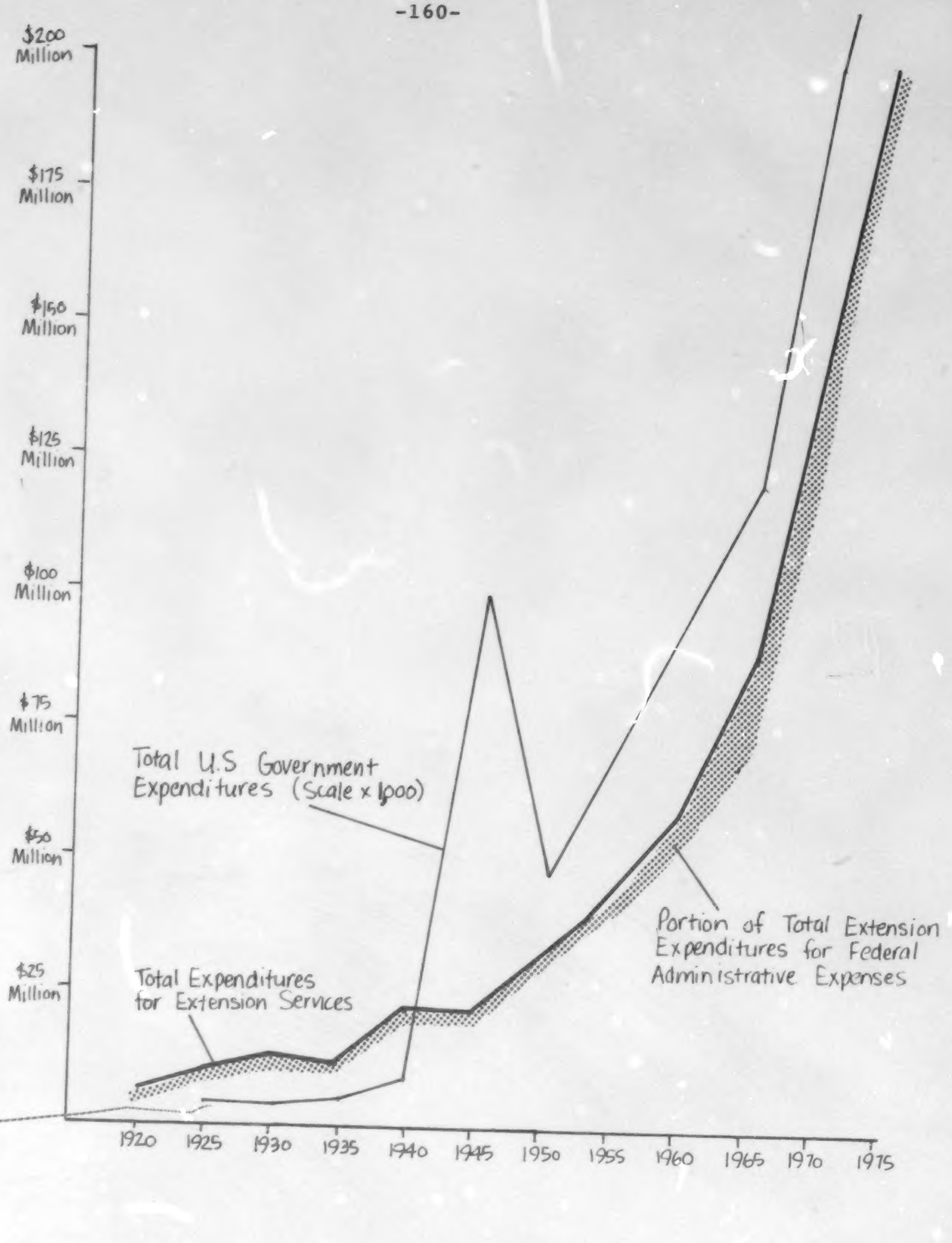


Chart XXVI. U.S. Appropriations for Agricultural Extension Programs, 1920-1974.

Source: U.S. Bureau of the Budget (1923 to 1974).

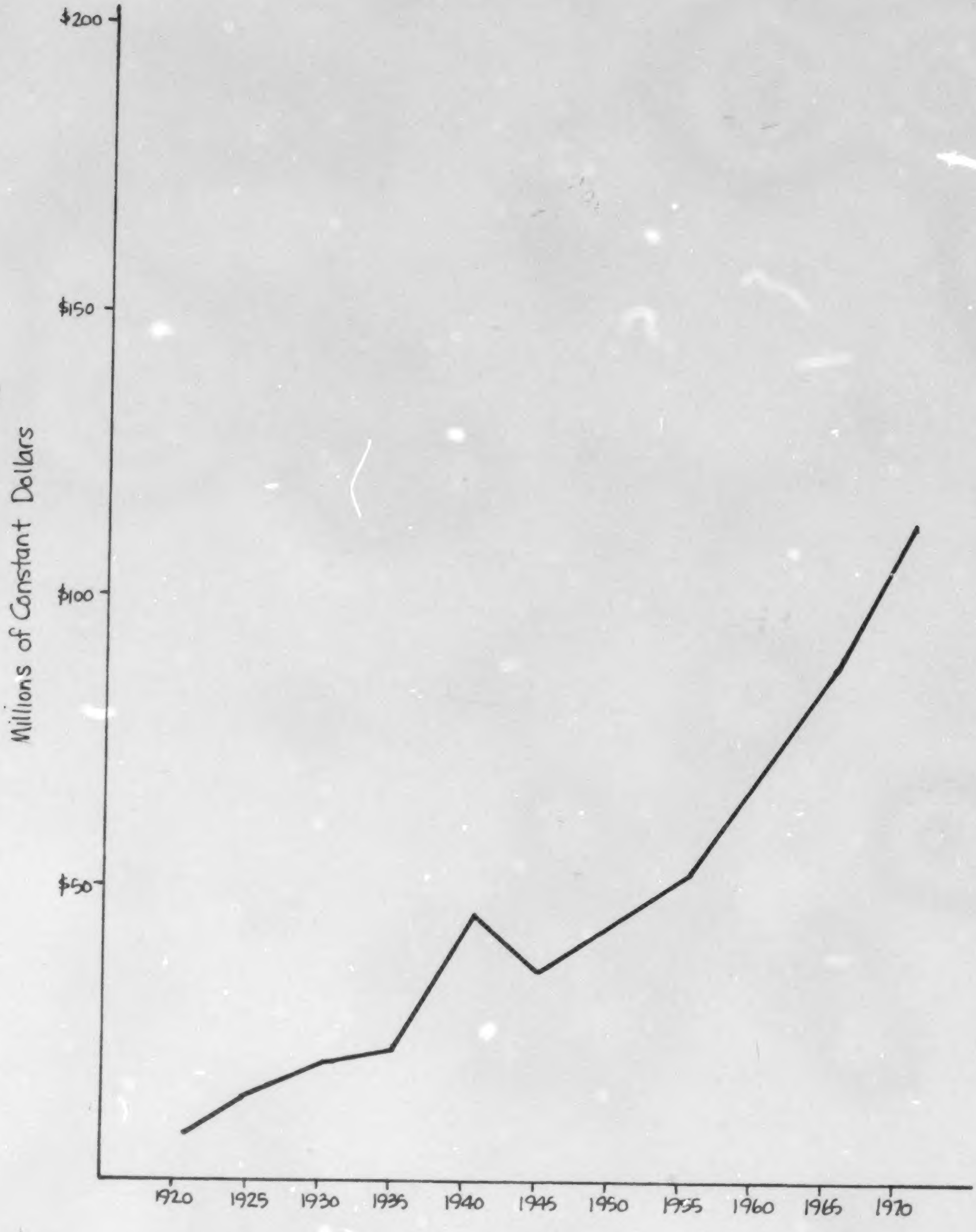


Chart XXVII. Federal Appropriations for Agricultural Extension Programs in Constant Dollars [Base = 1967], 1920-1970.

Source: U.B. Bureau of the Budget (1923 to 1974).

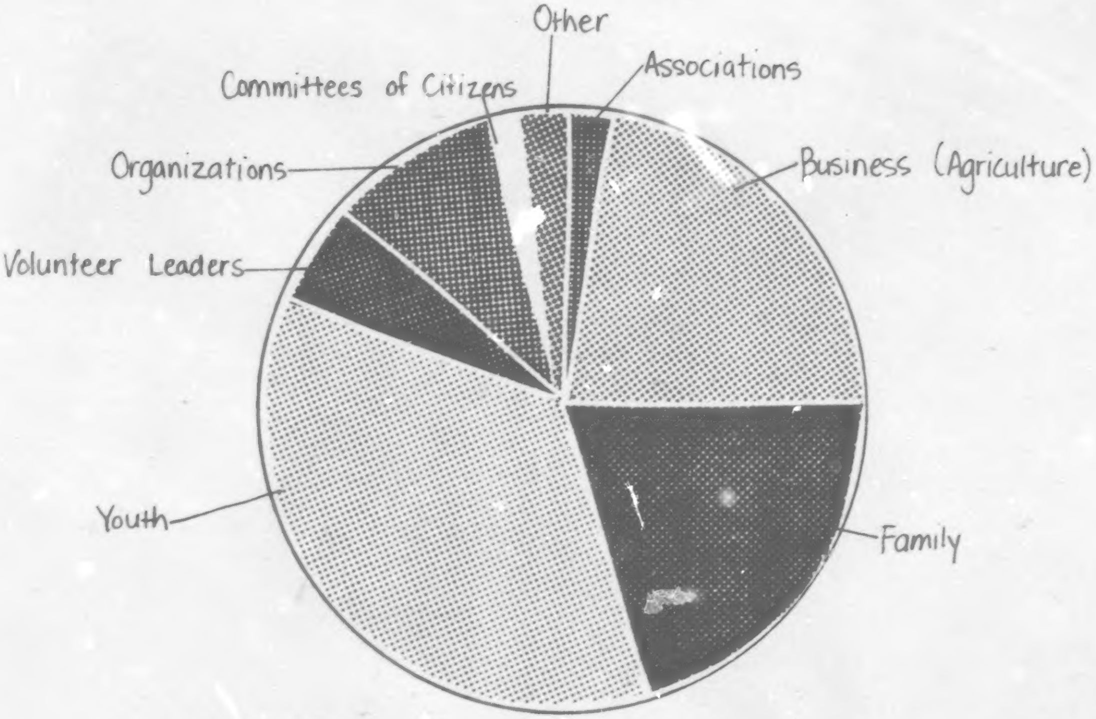


Chart XXVIII. Distribution of Extension Service Efforts in Contacts, 1973.

Source U.S. Federal Extension Service (1931 to 1974).

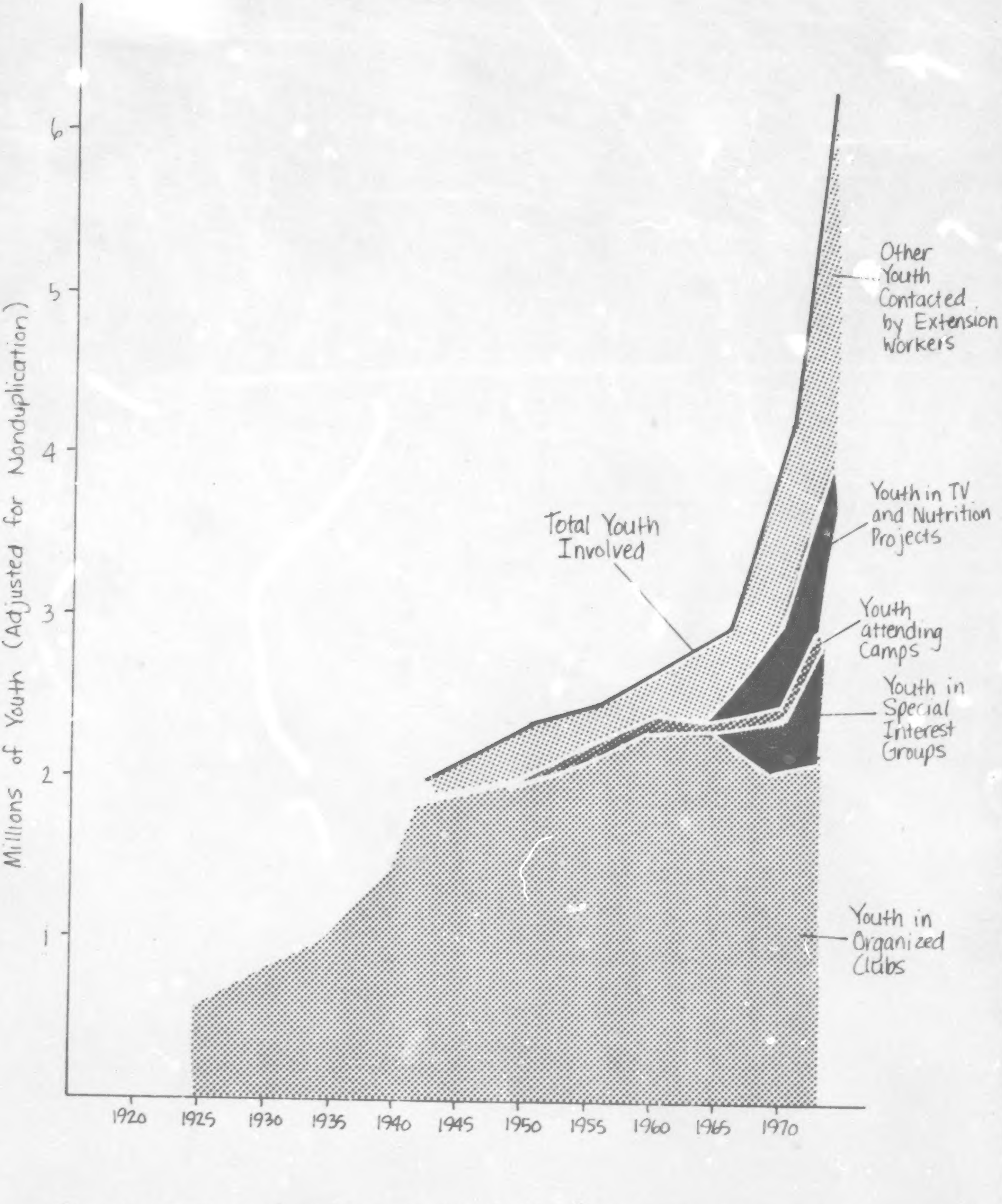


Chart XXIX. Enrollment in 4-H Programs, 1920-1970.

Source: U.S. Federal Extension Service (1931 to 1974).

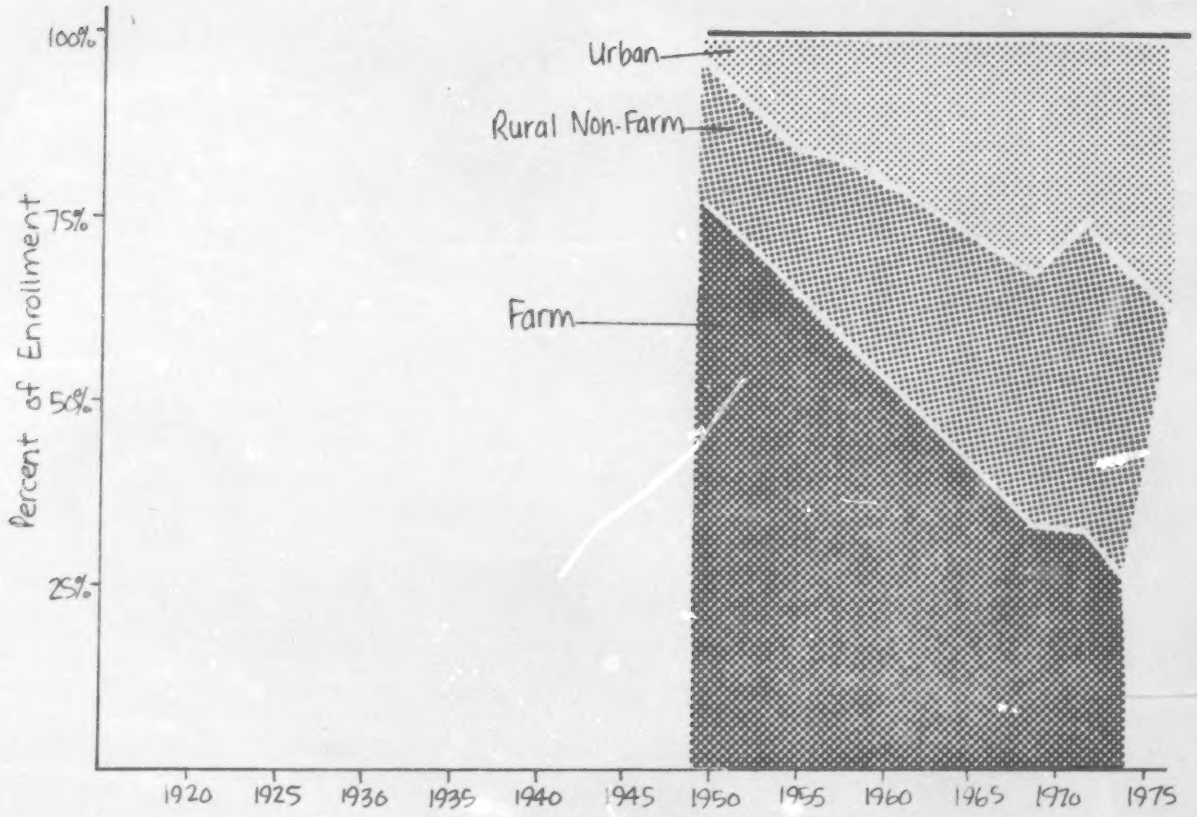


Chart XXX. Residence of 4-H Members, 1948-1973.

Source: U.S. Federal Extension Service (1931 to 1974).

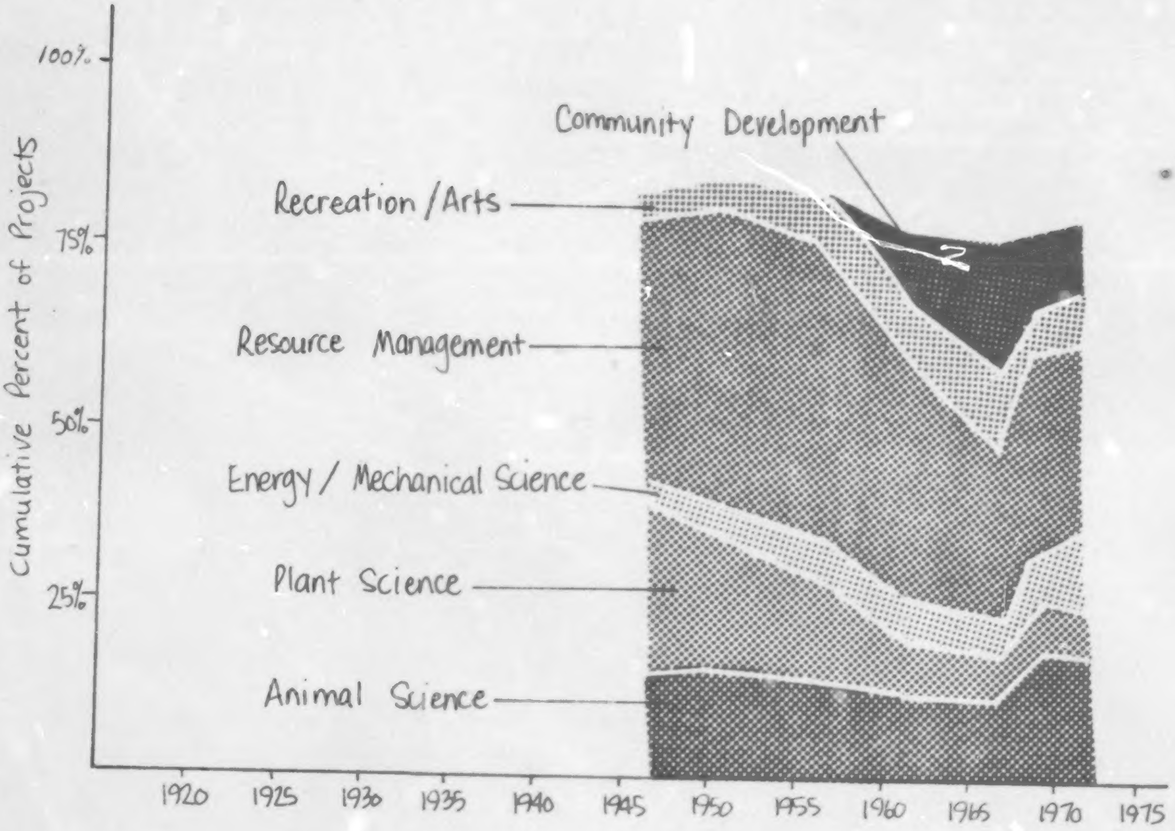


Chart XXXI. Changes in 4-H Project Categories as a Percent of Total Projects (Remaining Percents are Miscellaneous Projects), 1948-1973.

Source: U.S. Federal Extension Service (1931 to 1974).

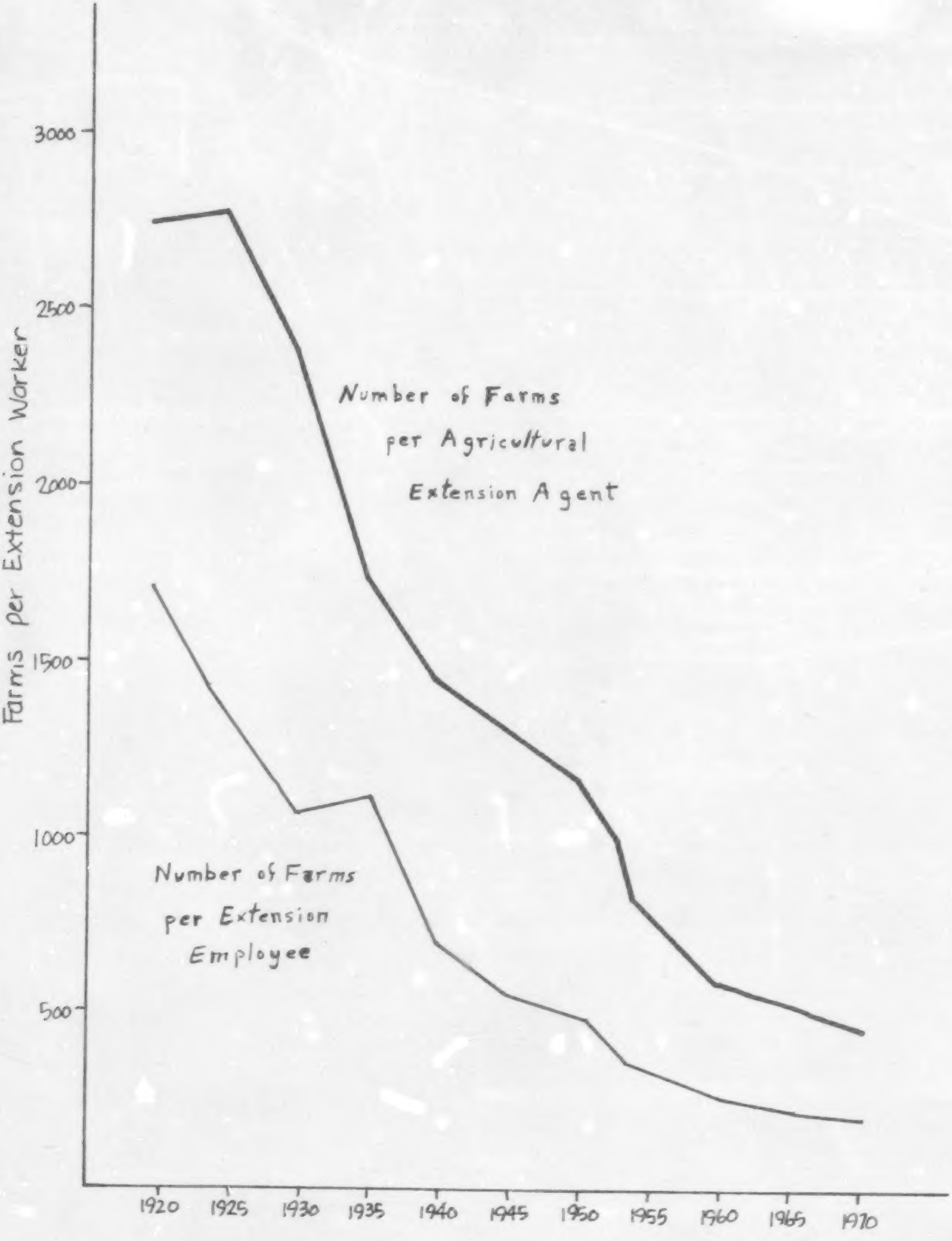


Chart XXXII. Farms per Extension Service Worker, 1920-1970.

Source: Census of Agriculture and U.S. Federal Extension Service (1931 to 1974).

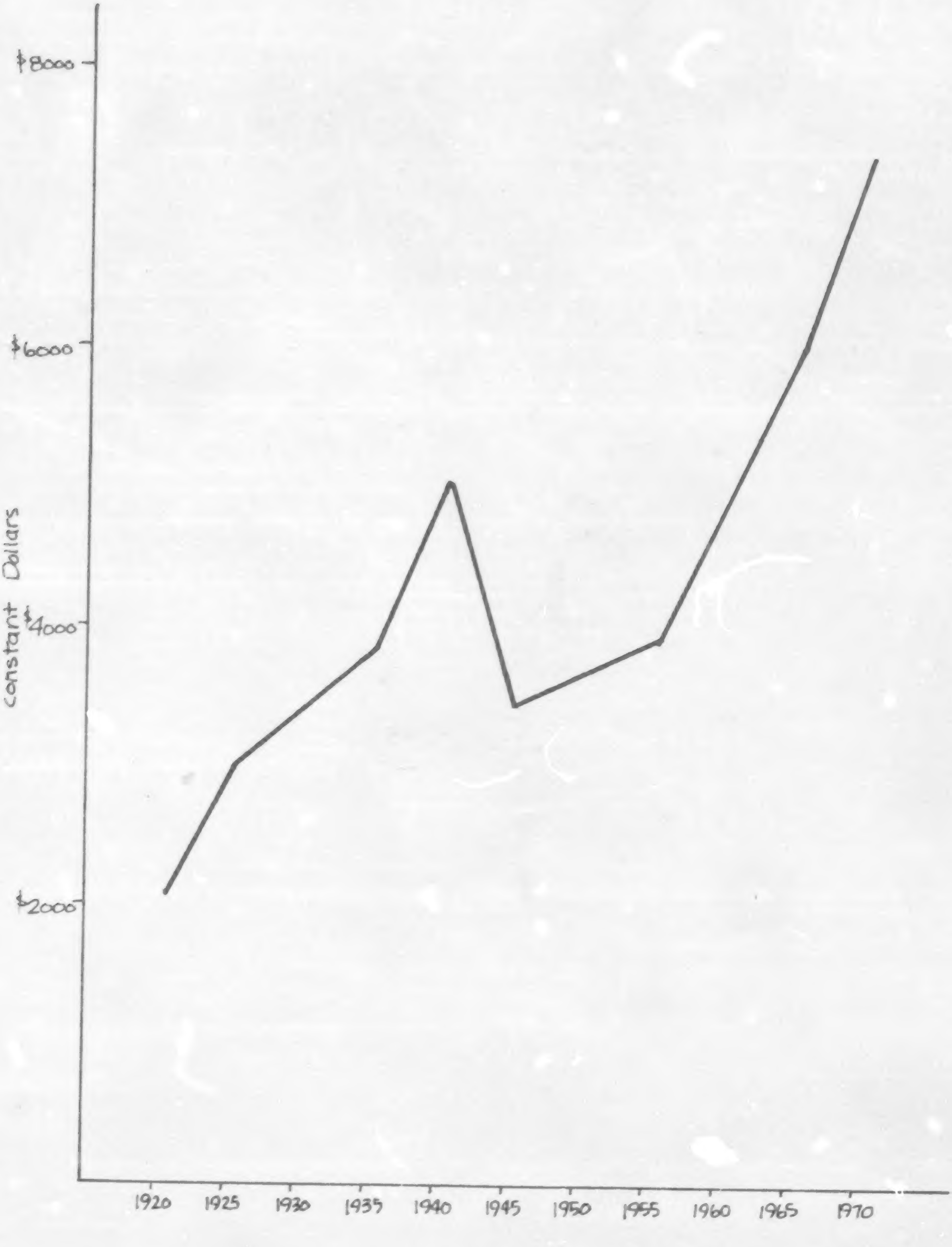


Chart XXXIII. Constant Dollar Cost per Extension Service Employee, 1920-1970.

Source: U.S. Federal Extension Service (1931 to 1974) and U.S. Bureau of the Budget (1923 to 1974).

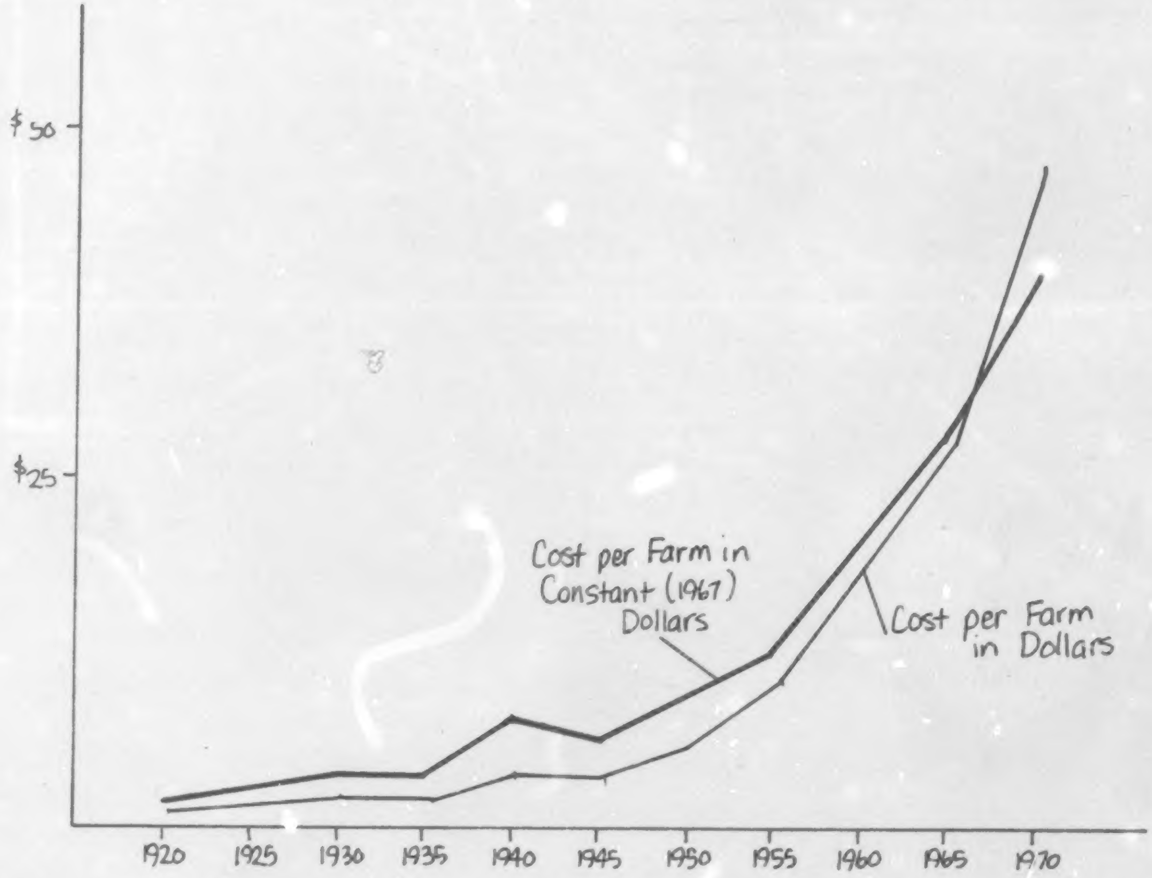


Chart XXXIV. Costs of the Extension Service, 1920-1970: Cost per Farm.

Source: Census of Agriculture and U.S. Bureau of the Budget (1923 to 1974).

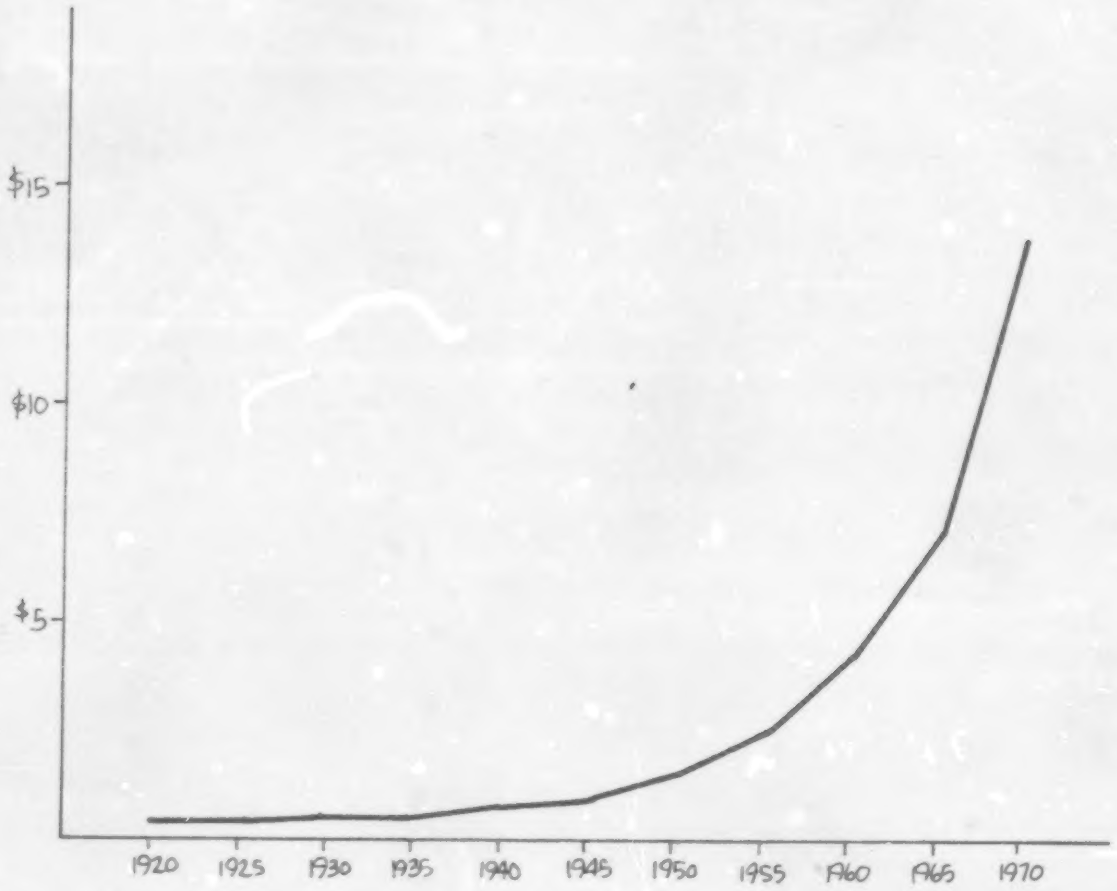


Chart XXXV. Costs of the Extension Service, 1920-1970: Cost per Rural Resident.

Source: Statistical Abstract and U.S. Bureau of the Budget (1923 to 1974).

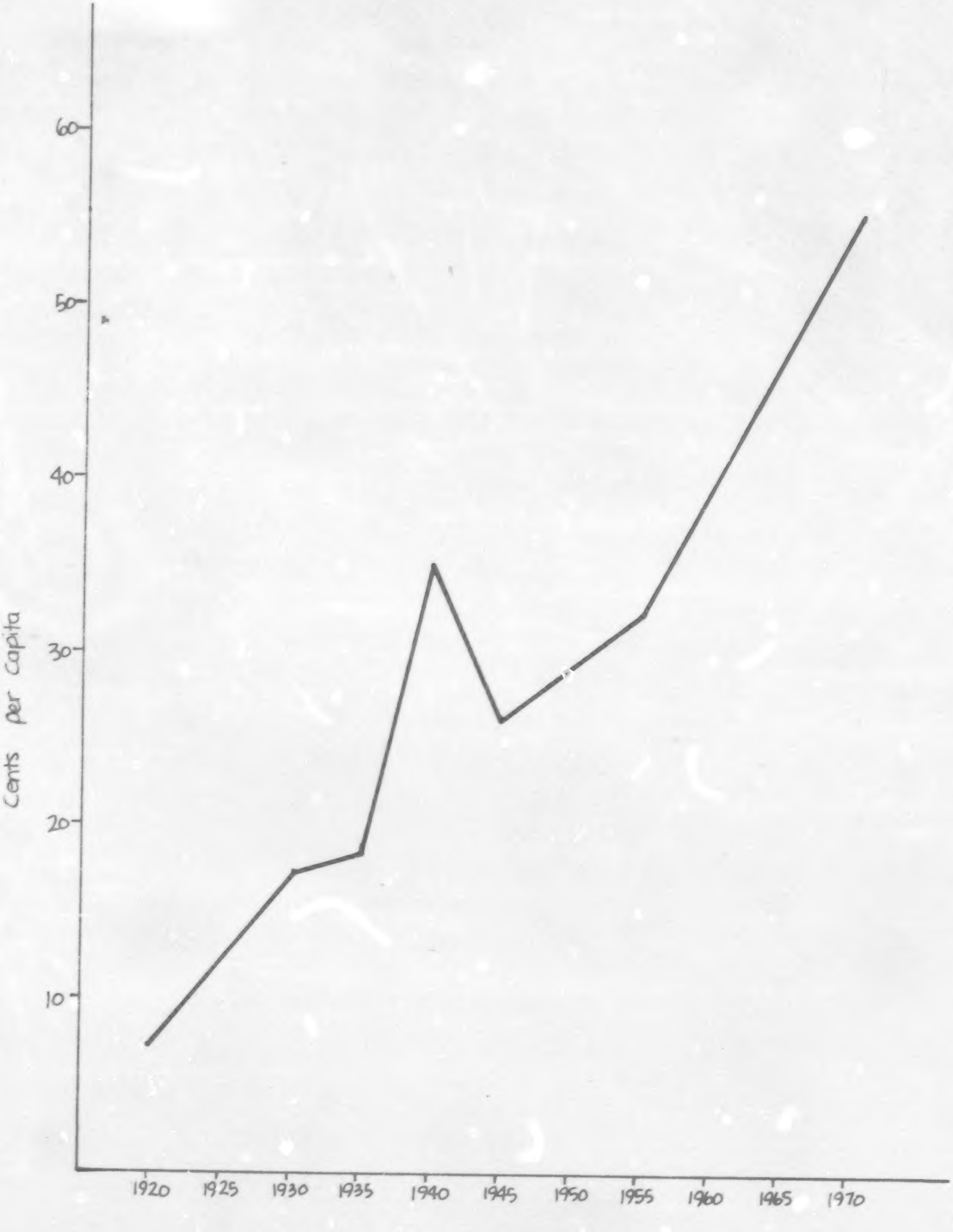


Chart XXXVI. Per Capita Cost of the Agricultural Extension Service (Constant Dollars), 1920-1970.

Source: Statistical Abstract and U.S. Bureau of the Budget (1923 to 1974).

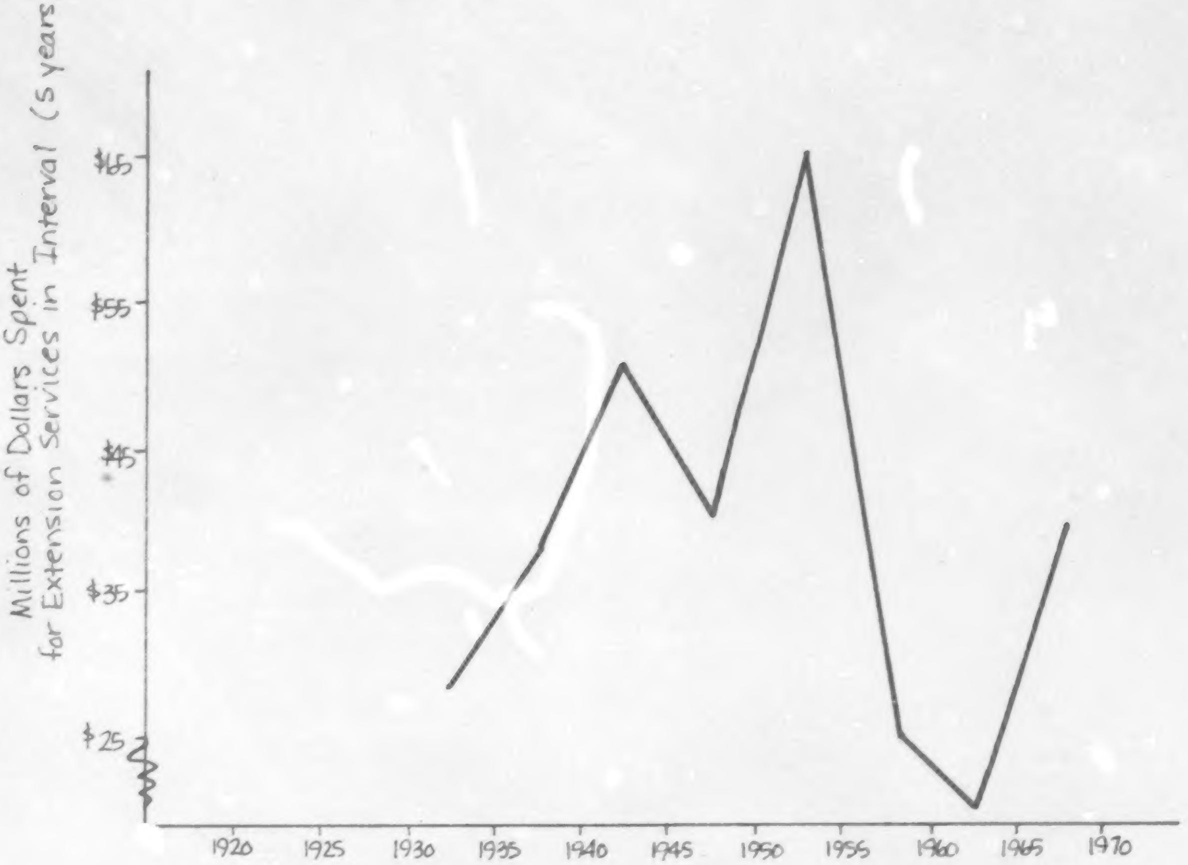


Chart XXXVII. Extension Costs Over Time of Increasing Corn Yield by One Bushel per Acre, 1933-1967: Total Investment in Extension Services (in Constant Dollars).

Source: Agricultural Statistics and U.S. Bureau of the Budget (1923 to 1974).

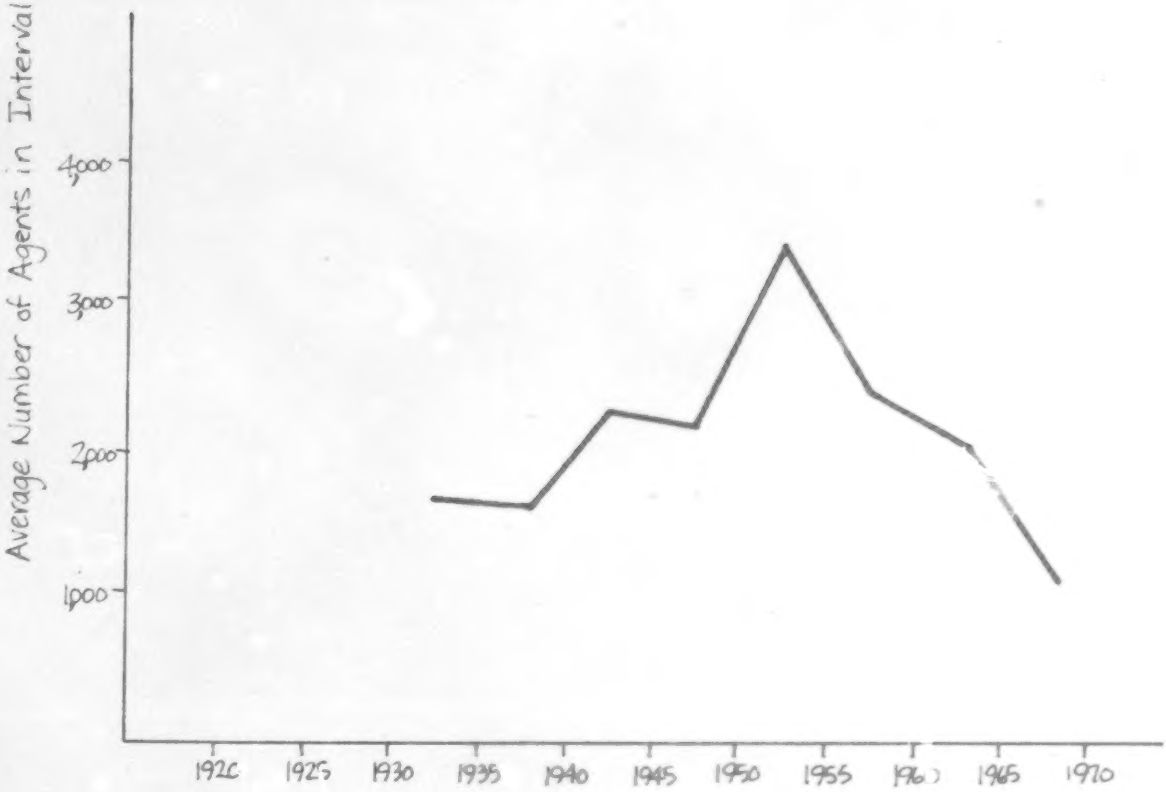


Chart XXXVIII. Extension Costs Over Time of Increasing Corn Yield by One Bushel per Acre, 1933-1967: Investment in Personnel.

Source: Agricultural Statistics and U.S. Federal Extension Service (1931 to 1974).